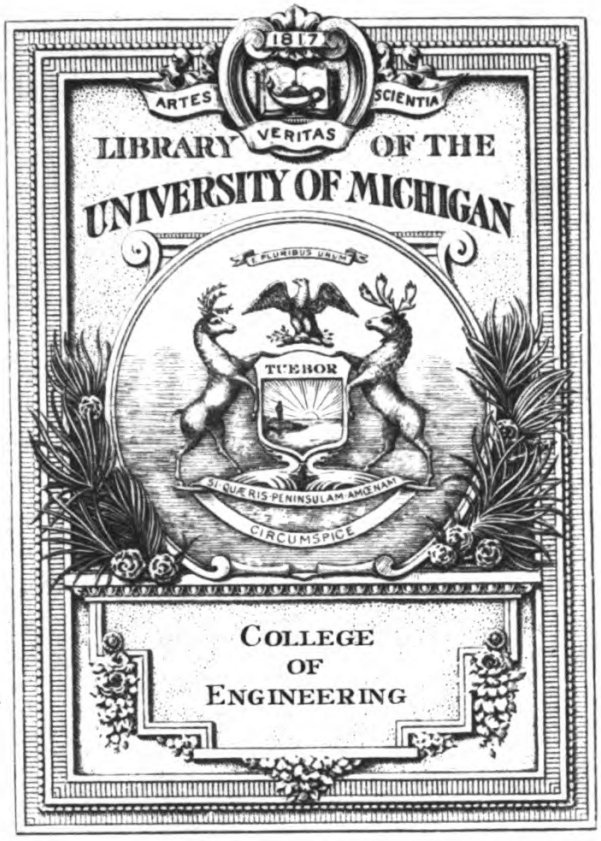

BOMBERS

Keith Ayling

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BOMBERS

ILLUSTRATED

Thomas Y. Crowell Company

THIS IS A WARTIME BOOK PRODUCED IN FULL COMPLIANCE WITH GOVERNMENT REGULATIONS FOR CONSERVATION OF PAPER AND OTHER ESSENTIAL MATERIALS.

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For Lorraine

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BOMBERS

Chapter One

A SHORT HISTORY OF BOMBERS

THE bomber is the ace of air power. The nation that can send the greatest number of first-line bombers over enemy territory, and can drop the heaviest weight of bombs consistently on military and industrial objectives, will win this global war.

The history of the bombing airplane is closely related with the history of war, but in the present conflict the bomber has played a more important part than ever before, and is likely to be the dominating factor in the achievement of ultimate victory.

In 1942 bombing from the air attained its thirtieth birthday. During the Balkan War of 1912, an English soldier of fortune named Snowdon Smedley, flying for the Italians, dropped a 100-pound bomb on the Turks. Of its effect we have no record, but he was the pioneer of attack from the air. We have progressed a long way since then.

Today the bomb aimer, which is the British term for bombardier, of a Halifax or Stirling, flying through dense clouds, fog and snow, can locate his target on the ground underneath by means of a "seeking" device, a combination of infra-red photography and television, and drop his bombs through the overcast with astonishing accuracy. No longer do the night bombing squadrons grope blindly through the darkness. Science has come to their aid, and provided the astonishing instrument that feels the contours of the ground and selects the target.

With his eye to the aperture of a powerful telescope through which he sees his target plainly framed between sighting hairs, and his finger controlling the knobs of the Norden or Sperry gyroscopic bombsight, the bombardier of an American high-altitude bomber can hit a target fifty yards in diameter from a height of 30,000 feet. Today young Americans are flying the war skies in huge armored battleships of the air, powered by four mighty engines, manned by a crew of eight to ten men. These streamlined monsters are precision built from nose to tail; they fight their way

through the heavily defended skies of Axis territory, shooting down enemy fighters that challenge them, and wreaking terrible destruction on objectives below that would not be visible to the naked eye. A captured German prisoner told the intelligence department of the Eighth Air Force that he and his comrades could not understand the accuracy of American bombing, recalling how, after an attack on one target, the military objectives were destroyed completely while the hospital and civilian installations were unhurt except for blast.

The accuracy of modern bombing has been demonstrated repeatedly since the United States Army Air Forces went into action against our enemies. One of the first instances of this was the sinking of the Japanese battleship *Haruna* by Corporal Meyer Levin, the bombardier of the Fortress piloted by Captain Colin Kelly. Levin had three bombs in his bomb bay when the *Haruna* was sighted through the clouds. From 20,000 feet a battleship on the surface of the sea appears little bigger than our view of a small insect on the ground.

Levin, carefully and painstakingly trained in the United States Army bombardment school, took over the command of the plane, which is the prerogative of the bombardier when making an attack. From that moment until he gives the signal "Bombs away" he is complete master of the aircraft. In this case Meyer Levin ordered his captain to come down to 18,000 feet. Levin then directed his run over the target, crossing the forward track of the Jap vessel. He unloosed his bombs as the ship came into the range of the sight. The first was a near miss, the second hit the *Haruna* smack amidships, the third grazed her side. It was remarkable shooting. It justified the United States Army Air Forces belief in precision bombing; it was a tribute to bombardier training and crew discipline. But it was only the beginning. Soon afterward from the Pacific came a report of how another bombardier, Lieutenant Smelser, sank or damaged six Japanese ships with eight bombs, an all-time high record for economy of weapons and precision aiming.

In the Battle of Midway, and later in the Coral Sea, American land-based bombers, supporting the onslaughts of torpedo and dive bombers, extracted a high toll from Japanese warships and transports. These early successes, however, were not perfection. They showed there was much to be done. Equipment had to be improved, tactics had to be evolved to meet unusual circumstances, and an ever-increasing amount of combat data had to be made available

to the rapidly enlarging air forces. Of all weapons in this war the bomber has made the fastest and most effective progress, particularly the American bomber. The reason for this is that the United States alone, of all the belligerents, has the industrial facilities to build and modify planes while actually at war. The Army Air Forces make a practice of asking for modifications to existing types based on combat experience. These suggestions are forwarded to the Matériel Command which passes them on to the manufacturers, and the improvements are embodied in the machines before delivery. It was recently revealed that no fewer than four hundred modifications were made in one type of bomber before the type itself reached the combat zone.

How these modifications are achieved without affecting production is one of the miracles of America's wartime ingenuity. In order to apply to new airplanes the requirements demonstrated by combat, the U.S.A.A.F. Matériel Command has dotted the nation with a series of modification centers. To these centers head the bombers direct from the production line. At each center are listed the improvements for each type as decided upon by the Matériel Command at Wright Field, Ohio. The planes are immediately passed through a miniature production line, where the changes are incorporated by specially trained Air Force ground crews, many of whom have had combat experience. Modifications may range from a new angle setting for a supercharger to the fitting of a new plexiglas nose complete with guns and bombardier equipment. Routine adustments include the fitting of exhaust dampers for machines destined for night flying, the provision of equipment for arctic flights, and readjustment of gun positions, based on reports from overseas. In some cases additional bomb racks may be provided; other machines may be adapted for special photographic missions.

The system has many advantages. The chief of these is that it enables our warplanes to reach the combat lines absolutely up-to-date. If the suggested modifications were executed on the actual production lines, valuable man hours would be lost while continual adjustment was being made to assembly equipment, to tools and jigs. In Germany and in England, where machines are manufactured almost under the shadow of the wings of enemy planes, this modification, which would require retooling and increase of man hours, is not always possible. In America it is a "must," and as such is responsible for the superiority of our bombardment forces.

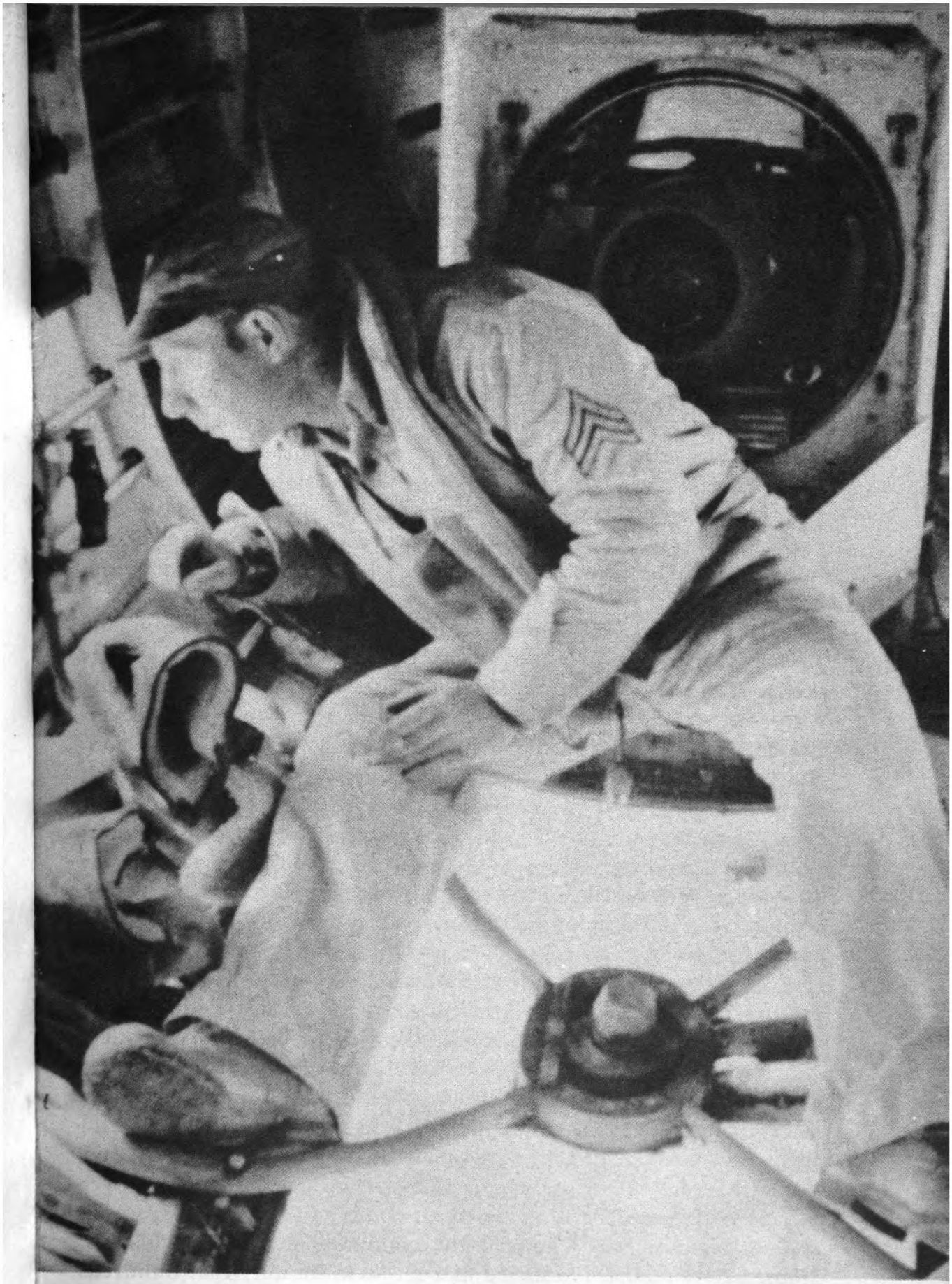
Bombardment by airplane made its first real start in World War I.

It was not very scientific, and it called for a great deal of courage on the part of the fliers, and some degree of skill. About it there was an element of sport, rather than precision skill. It was something like going hunting and taking a shot at a running deer with a .30-caliber rifle, or shooting at a pigeon on the wing with an arrow. Under certain conditions you obtained a hit; more often you did not. If you had to make a hit, you flew so low that you ran the risk of being blown up by the explosion of your own bombs, which sometimes happened.

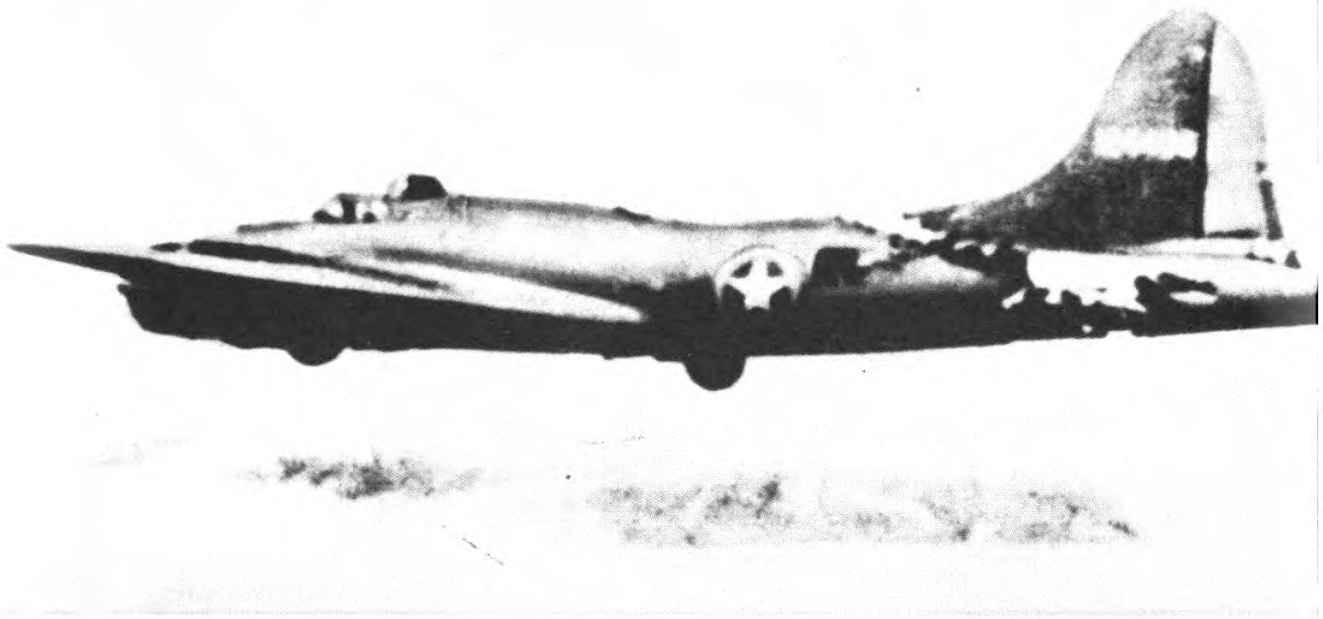
The early bombing planes were actually built for reconnaissance purposes. The German and Allied armies prior to 1914 looked upon the airplane as the eyes of the army. Just as in 1870 the French and German armies sent up balloons to act as observation posts, so it was intended that the airplane fly over enemy territory to enable trained observers to spot the position of rival armies. In the early days both the sides used airplanes for this purpose, and when the rival planes met each other the pilots would greet each other with a wave of the hand.

The high commands on both sides, however, were thinking of bombing as an offensive weapon. In the United States and in Paris competitions had already been held to see if it was possible to obtain any accuracy of drop, and some astonishing results had been obtained. The British were the first to strike with the new weapon. Four aviators attached to the British Navy set out from Antwerp in Belgium to bomb the Zeppelin shed at Düsseldorf and actually scored a direct hit, burning a huge gasbag which the enemy was doubtless preparing for raids on England. Another naval aviator flew to Cologne on the same day and hit the railway station, causing considerable alarm among the population, according to intelligence reports received.

The planes used were Sopwith biplanes. The bombs, which weighed twenty-five pounds, were crude affairs and were carried in racks underneath the fuselage. To release them the observer pulled out a pin, and down went the bomb, to which was attached a cloth tail to give it some degree of directional control. There were no bomb-sights, which meant that the fliers had to use their judgment, and fly as low as possible to be sure of hitting something. Shortly after the two successful sorties one of the same airmen lost himself over Germany and on returning aimed his bomb at a column of German troops. His aim was wild and the bomb fell in neutral Holland. Immediately reports blossomed like daisies in summer that hundreds



This Liberator tail gunner has clambered out of his "boil" for a brief rest over the belly gunner's window. His interest is centered on the fleeing remnants of a formation of Nazi planes, beaten off by his own formation of big bombers on their way to an Italian objective. *Acme.*



Clear evidence of the efficiency of the electronically controlled auto-pilot is given in these flight and close-up shots of the Fortress that flew home after its midair collision with a German Messerschmitt. Details show how manual control cables connecting to the rudder and elevators were severed. *U. S. Army Air Forces.*

of women and children had been killed, the target allegedly being a church and a school. The incident had a sobering effect on the British public, however, and several spokesmen advocated stopping the practice.

The Germans were not long in replying. On Christmas Day, 1914, after the British had bombed the Zeppelin factory at Friedrichshafen, a lone German aviator flew over Dover and dropped the first bomb on the British Isles. It did no damage, but it was a symbol that the air arm was going to play rough. From that moment bombing became a recognized form of attack, although it was not for a good two years or more that bombs were dropped from airplanes with any degree of accuracy.

For the first year and a half the Germans were using Zeppelins, which made regular visits to England and Scotland. Their bombing, however, was of the terrorist kind, and did little real damage. The British could not retaliate by similar bombing of Germany. All they could do was to shoot down the Zeppelins, which were highly vulnerable, being filled with inflammable gas. Night-flying planes and improved antiaircraft guns soon made the use of these airships too costly, so the Germans developed the Gotha bomber, probably the best bomber of the last war. Its outstanding feature was that the bombs and gasoline were massed round the center of gravity, making it extremely easy to fly. These Gothas made several daylight raids on Britain. Many were shot down by R.F.C. scout planes and antiaircraft guns. Then, as in this war, when British defenses and scout planes made it unprofitable for the Germans to make raids by daylight, they confined themselves to raids at night, or at dusk. In the latter days of the war the Gothas made a practice of coming over to bomb the airfields from which night bombers were operating. These raids were rendered ineffective by the simple procedure of constructing dummy airfields marked out with flare pots to draw the enemy bombs.

In many respects the pattern of air warfare in 1914–18 followed that of this present conflict. The British did not start their bombing until late in the war, and not until they had first worn down the enemy bomber and fighter strength. It was not until Sopwith triplanes and the FE-2b fighters, later to be used as bombers, had mastered the German Fokkers and Albatross scouts, that the British began to think of using the airplane as a bombardment support for ground forces. From the beginning of 1915 until the end of 1916 things were going badly for the Allies. The German scouts were

mastering the skies, and the fields of Flanders were littered with broken wings.

Two machines did more than any others to turn the tide of battle. One was the FE-2b, a pusher biplane which had an extraordinary degree of maneuverability, even if it was slow. The outstanding feature of the FE-2b was that the observer or air-gunner sat in front of the pilot with a flexible machine gun, later with two on a single mounting. While the Germans with their new synchronized guns had to aim their machines at the target, as does the modern fighter plane, the FE-2b gunner had a wide range of fire. When attacked, the pilot of the FE-2b put his machine into a vertical bank, kept it there, turning tightly, and the gunner played havoc with the attacking German planes. The FE-2b had such a sturdy construction and weight-lifting ability that it was soon fitted with bomb racks, and thus combined the duties of bombing and fighting.

Then came the super-machine of the war, the Bristol fighter. A young flying officer named Frank Barnwell, who had been a designer of airplanes before the war, went to France and saw the destruction wrought by the Germans on the British planes. He returned to England with an idea. This was that if a plane could be designed which would be able to bomb by daylight as well as fight, air supremacy would be a matter of time and numbers of planes put into the air. Barnwell had seen many of his squadron mates shot down as a result of the enemy getting on their tails. He decided that the tail of a plane must be defended, and at the same time the pilot must have forward-firing guns to enable him to follow orthodox fighter practice. Barnwell had already designed a monoplane fighter which was years ahead of its time, but the Air Ministry had turned it down, because of its high landing speed. This time he was to produce a biplane that was needed. The men at the top of the Air Ministry believed in him, and he went to work to put everything he knew, everything he dreamed of, into the new plane. In designing the plane, he had an additional incentive. His brother Harold, who had shared his early efforts to fly, had been killed in action with the Royal Flying Corps.

One day early in 1917 the new fighter-bomber arrived. The Bristol Fighter, as it was termed, was the last word in aerial efficiency. Powered by a 250-hp. Rolls-Royce engine, it was a sturdy biplane with a humpback fuselage. The hump was the gunner's cockpit. Here within talking distance of the pilot the gunner sat with a Lewis gun on a scarf mounting. His field of fire covered the entire rear of

the plane, and if need be he could shoot forward and up, or forward and down. The pilot had two guns at his disposal, one a Vickers machine gun, the other a Lewis mounted on the top plane. Underneath the wings were bomb racks. The machine had the speed of the average fighter, a formidable dive, and could be thrown about with astonishing ease. How well Barnwell had succeeded was quickly demonstrated. R.F.C. pilots were crazy about their new mounts.

The first squadron equipped with Bristols was attacked by a formation of German Albatrosses, over Amiens. The Germans swept down with complete confidence. The Bristols turned to give battle still in formation, and shot down four of the enemy without loss. That was the beginning. Soon the German scouts began to treat the Bristols with respect and the fame of the two-seater fighter became a legend.

In 1917 the British began to use the Bristols and the De Havilland as a similar type of machine for short distance daylight raids, employing the FE-2b as the medium distance night-raider. These machines, engaged in bombing railheads and dumps and troops, inaugurated the first regular program of strategic bombing which followed a definite pattern until the end of the war. The FE-2b could stay in the air for about three and a half hours and carry one 250-pound bomb and four 25-pounders. It was ideal for night flying, being extremely docile and capable of landing at low speed—about forty miles per hour.

Memories of night-bombing raids over Belgium and behind the German lines in France are still vivid to the writer. Day-flying pilots considered the night-flier as a miracle man, and a little bit of a crazy man for volunteering for such a "risky" operation, while we of the night-flying squadrons thought we had the softest job of the war, because we rarely encountered opposition more dangerous than antiaircraft fire, and searchlights which were easily avoided. Our greatest danger at the time seemed to be the possibility of engine failure over enemy lines, and the difficulty of making forced landings at night. Some of us were lucky; those who were not did not survive to tell their experiences. The old FE-2b was a honey for night flying. Loaded to capacity with one 112-pound bomb, and two or four 25-pound bombs, it would stagger into the air after an astonishingly short run and take an amazing amount of punishment. If a forced landing was necessary the machine could be put down on the proverbial handkerchief, and should it turn turtle it had the obliging habit of throwing the pilot and observer clear of the

wreckage. Its water-cooled 120-hp. engine was as reliable as any, being capable of flying home with red-hot cylinders, fractured water jackets, and with shattered propellers.

Night bombing in those days was far from scientific. We flew with our senses and a little navigation. The observer was the navigator, the pilot the bomb aimer. We had bombsights which gave us the direction of our run, made into wind to avoid the effect of drift. On arriving at the target area we used to fly around, spot what might or might not be the target—our ability to see it depended entirely on the visibility—and then let go the bomb or bombs. In some cases we dropped parachute flares to illuminate the ground below. On moonlight nights our work was comparatively easy; on cloudy nights it was exasperating. Weather conditions were the night-bombing squadrons' worst enemy. At take-off the sky would be cloudless, and half an hour later a thick fog would envelop the countryside. Night-landing fields were few and far between. The machines had radio for sending, not for receiving; if a pilot was lost, he had to find himself by the stars or landmarks, and get back as best he could. Yet losses were surprisingly low, and the results gratifying. This form of bombing continued until the signing of the Armistice.

In 1917 the British decided to carry the war to Germany and produced two bombers that had many of the features we find in the modern American bomber, which basically is without doubt the best in the world in all classes.

The first British long-distance bomber of note was the twin-motored Handley-Page, the same concern that today produces the giant Halifaxes. The first Handley-Page carried more than a ton of bombs, was armor plated, and powered by two 250-hp. Rolls-Royce engines. Later, fitted with 350-hp. motors and electrically operated bomb bays, other machines of this type flew regularly against German munitions plants in the Rhineland.

In the meantime the father of the modern bomber was being born. Handley-Page built a machine intended to bomb Berlin, to give the Germans a taste of what they had given London with their Gothas. This was a big four-motored biplane capable of carrying six tons of useful load, including three tons of bombs, and a thousand gallons of gasoline which gave it a range of one thousand miles. During its test this remarkable machine took to the air over London with forty passengers. It went into production too late, however, for use

against the Germans, but in subsequent operations the four-engined giant did good work in Irak, India, and Palestine.

Both the French and the Italians had also been steadily developing their big bombers. The Italians produced a three-engined Caproni with a formidable weight-lifting capacity. One of the most interesting features of this machine was that it had a double tricycle undercarriage, and landed with its tail up, just as do many of our own front-line bombers today.

Although few American planes got to France during World War I, the American conception of bombing, which is winning this war today, was born in France. General Billy Mitchell was operating with American-built but British-designed DH-9's, and with French Farmans. He came back to the United States with the profound conviction that bombing was the dominant factor in air power.

American industry, which had been building the DH-9a and the famous Packard Liberty motor that powered the 9a, was also concentrating on the production of bombers, and many outstanding types were produced. In most cases the designers were ahead of the materials at their disposal. Existing engines were heavy for the power they produced and construction materials were not adequate for the stresses imposed on them. The desire to produce a bomber with good clean lines and high performance was, however, predominant, and in the years immediately following the war the concept of the present American bomber was actually born.

Many remarkable machines were produced. The Curtiss Company, Glenn Martin, and other names now famous in our war production turned their attention to the building of bombers. One machine built in 1920 was powered by two motors giving 1000 hp. and carried three tons of bombs.

Another machine, the Gaulelet, was years ahead of its time. This was a low-winged single-engined monoplane which had everything but performance. Its construction was too flimsy, its engines too heavy. Only its design was good.

There was a night bomber with three 450-hp. Liberty motors, and the Barling bomber with six engines giving 2400 hp. Although it never went into service, this machine demonstrated that the United States could build big bombers as well as any other country.

By 1924 the United States Army had become bomber conscious and there began a long line of bombers that fathered the type in use today.

In 1925 the first Keystone bomber made its appearance. It had a 66-foot span and was powered by a single 800-hp. engine, and was fitted with machine guns for protection.

Then came the era of twin-engined bombers. The United States Army Air Corps decided that it needed bombers and not freak giants of unproven capabilities. The first of the planes to meet the demand was the famous Curtiss Condor, a twin-engined biplane with a high performance for its day. Then came twin-engined machines bearing such famous names as Douglas, Martin, Consolidated, Boeing, and Lockheed.

From 1927 onwards American designers concentrated on fast twin-motored ships. In 1932 Glenn Martin produced the B-10, with two 650-hp. Wright Cyclone motors, fastest medium bomber of its day, the forerunner of the now famous Maryland. From Tom Douglas's all-metal ship with two supercharged Wright Cyclones, and capable of 210 miles per hour, we can trace the ancestry of the Boston and the Havoc, American-made bombers which have played an important part in the defense of Britain.

1934 saw the most important event in the history of American bombers, the birth of the Boeing Flying Fortress, which is without a doubt the best all-round aircraft in service today. We shall talk more about the Boeing later. Sufficient to say here that no other country can match it for performance and utility.

Modern bombers are divided into three classes: heavy, medium, and light or fighter-bombers, with the dive bomber, an early American invention, in the third class. Among America's heavies we have the Boeing B-17G and B-29 and the Consolidated B-24 Liberator, four-engined giants capable of carrying heavy loads over considerable distances. In the extra heavy class we have the experimental Douglas B-19 and the Martin Mars. British big fellows are the Short Stirling, Handley-Page Halifax, and Avro Lancaster. In the American medium class are the Martin B-26 Marauder, the Douglas A-20 (Boston or Havoc), and the North American B-25 Mitchell, that accomplished the famous raid on Tokyo.

In the light or dive-bomber class we have the Douglas Dauntless (the Army's A-24), the Vultee Vengeance, and the Curtiss Helldiver (the Army's A-25), which is said to be the most powerful dive bomber in any service.

In considering all military airplanes we must remember one important fact. Each is a tailor-made job for a certain task. In some cases American-manufactured bombers have been pressed into serv-

ice as fighters and have distinguished themselves because of their superior speed. An exceptional example of this is the Douglas Boston, used for short daylight raids over France by the R.A.F. and doubling as a night fighter. A slightly modified version of the A-20 distinguished itself as a fast low-flying attack plane in the North African campaign, and reports from Europe tell of its successful activity as a dive bomber.

The ideal bomber must be a good weight carrier. It must also have a long range, which means a large fuel-carrying capacity, and it must carry enough defensive armament to be able to beat off attacks from enemy fighters. In producing such machines the designer is faced with many problems. He must fit high lift wings to get a high power loading. In doing this he sacrifices maneuverability. He must give his machine the greatest feasible speed and a high rate of climb and he must fit armor to protect pilot and crew against attack by enemy fighters.

The reason that the British have done the greater part of their bombing at night is because they designed their bombers to carry the greatest possible load over a comparatively short distance, eight tons over an 800-mile round trip at a medium altitude.

American heavy bombers were originally designed to carry smaller bomb loads at high altitude to engage in precision bombing. Using turbosupercharged motors, they achieve heights above normal antiaircraft fire and attain a speed at high altitudes that nearly matches that of enemy fighter ships. Now with increased load capacity and armament and an ever-increasing range they carry the war to areas that would normally be out of reach.

While it is difficult to label any aircraft as the "best," there is no doubt that in heavy high-altitude bombers the United States has a corner on the world market.

Chapter Two

HEAVY BOMBER

A BIG bomber is an exciting thing at any time. On the ground you see it massive and lifeless. As you walk close up to it, and stand under its huge wings, it gives you the impression of being some huge and permanent structure, so immense that you wonder it could ever leave the ground.

You climb aboard and you are in a new world, a world of instruments, leather armchairs, windows, guns, innumerable pipelines, switches, fire extinguishers, slim doors; you are in a huge corridor, with bulkheads like a ship's. In the nose is a duplex apartment, the ground floor occupied by the bombardier and front gunner, the top by the two pilots and the navigator. You sit in one of the seats and try to assimilate all you see before you. There are banks of instruments, dials, printed labels—some in red, some in blue. You see telephones, pressure gauges, heating apparatus, parachutes, and a labyrinth of pipes and conduits. As you look ahead, you see the sky; but look down. You are about as high as the third floor of a house. Men on the field look diminutive. You can see the top of the truck that is feeding gasoline to one of the huge tanks. You go down into the "sun parlor" glass nose of the giant for a bird's-eye view of the ground activities. Supposing you had to get out of this machine in a hurry! It would be quite a jump, too low for a parachute of course, but too high for comfort. A fighter plane is taxiing toward the runway. It goes past you looking like a dwarf.

As you sit in the "office" of one of these 70,000-pound monsters, you get an impression of permanent solidity, of massive bulk, of sturdy rigidity. Here is something so strongly built that it seems practically indestructible. You recall having seen an automobile crash into and tear a large hole in a wall. The automobile suffered only superficial damage. Its hood was dented, and the glass of the headlights shattered, but its steel construction had won the battle of ramming. Suppose this great giant were to crash into a wall, into a house, into a fleet of automobiles! Nothing could stand against it.

Consider those giant double-row radial engines with their gleaming three-blader propellers. There is more power in those engines

than ever went into an automobile. See those graceful, tapering, metal-skinned wings. They are stronger than the body work of your family car. You could walk on them without denting them. Everything about this bomber seems superstrong, superdurable, as durable as a battle-wagon of the Navy.

Then you remember a recent communique of air operations. "Seventeen of our bombers are missing." Seventeen of these giants were knocked out during a raid over enemy territory. How could that happen? It does not seem possible that this creature can be crippled. You catch a brief glimpse then, perhaps, of what happens when enemy shells and bullets have pierced the steel hide of the mammoth, when the interior fills with smoke and flames, when 70,000 pounds get out of control and hurtle in a flaming mass to the ground below. "These are escape hatches," points out one of the crew. "We use them when we have to bail out."

It is a common hazard of war. The sky is dotted with parachutes, and this grand monster is diving derelict to destruction, still giving you the impression of being indestructible. This huge solid thing is as secure as a fort. There is nothing flimsy about it. If someone dropped you inside this bomber blindfolded, without telling you where you were, when they removed the blindfold you might guess you were in a ship, or in a submarine. It smells rather like a ship, with the warm odor of oil, gas, leather, and paint. But you are in a bomber, the flying ship that is likely to do more to win the war than any other weapon in use on land, sea, or in the sky.

You are going to take a flight. The pilot finds you a place behind him and his co-pilot, and you wait happily while the pilot and aircrew go through the check-routine preliminary to the take-off. Each pilot has his special duties. The check-list seems interminable. Finally, the engines purring, the bomber turns and heads toward the runway.

"This is Bomber 12-024 waiting to take off on training flight," says the pilot.

"Bomber 12-024 on training flight, your runway is No. 4," replies the radio. "Acknowledge."

"Bomber 12-024. I am heading for runway No. 4," repeats the co-pilot.

The machine taxies across the airfield. The flight-control officer speaks again. "Bomber 12-024, wait where you are. There is a B-25 coming in with a priority. You will proceed to the runway when he is clear."

You wait, the engines reduced to a tick-over. A slim Mitchell bomber darts down, lands on its three wheels, and streaks across to the parking lot. "You are expected on runway No. 4," calls the flight-control officer. "Bomber 12-024 heading toward runway No. 4," says your pilot. In a matter of seconds he has turned his huge craft nose into wind and you are thundering down the runway.

If the crew have given you earphones, you are lucky, for you can hear what is being sent over the voice-jammed ether. The air over an airfield is as full of conversation as a woman's veil is full of holes. Everyone is talking, but the big boss of the air is the flight-control officer. When he tells a pilot to make another circuit of the airfield, he means it. Unless the plane is in trouble and has a very good excuse to land, there is no alternative but to obey. Sometimes the flight-control officers blast; sometimes they are mildly humorous. They do a lot of talking in the course of a day's flying.

The engines of the machine in which you are flying are at full throttle. The tail is up. You look at your watch. One second, two seconds, three, four . . . five. The rumbling underneath made by the huge tires that support the machine on the ground ceases. Suddenly you are off. You relish the smooth, silky, lighter-than-air feeling as the bomber rises into the air. Airborne! This huge creature is flying at last. "Retract landing gear," orders the pilot. The co-pilot works a red handle which sets in action the hydraulic retraction gear. "Landing gear retracted," he replies.

The flight-control officer speaks again. "Bomber 12-024, you are too near the incoming land. There is a pupil flying solo in an SJ-14 to your port, at nine o'clock. Don't go too near him."

The nose is pointing skyward now. The thundering burble of the engines changes to a steady roar. You watch the pilot's hands. He moves them ever so slightly and the huge machine heels over. You see land appear along the tip of the starboard wing. The pilot looks at you and smiles, "She handles like a put-put."

You are likely to remember your first flight in one of these big ships, how you peered out of the Plexiglas nose, watched the navigator at his table with his instruments. You squinted through the bombsight and lay flat on your stomach to watch the ball-turret gunner crouched at his gun. As you come in to land, you watch the crew go through their routine once more. You feel the wheels touch. The smooth progress of the machine is checked by the rumbling of the wheels along the ground. You make note of an impression you caught during the flight. It was like traveling in a railway coach

without the clack of the rails, or like being in a penthouse that was flying. All the time you felt tremendously secure.

Once on the ground, you take another look at the bomber you have just left. Its immense size hits you in the eye. It hits harder this time, because you know this huge thing does fly, and you have experienced its swift nimble progress in the air. You are still a trifle staggered at it all.

You watch the bomber take off again, this time with a new crew on a training flight. As it taxies to the runway it seems to you rather like an oversized mechanical lizard. It groans and roars as it turns. Once as it hesitated and the pilot gave one pair of engines the gun, the machine sounded as if it were screaming in protest. Then you hear the concerted roar of the mighty motors as the giant heads down the runway—up goes the tail. The great nose seems to protrude suddenly like a swan or duck in flight. Your fancy of course—and then you see the great wheels climb into the air, the nose pulls up, and away she soars, a graceful thing as beautiful and inspiring as a windjammer in full sail beating along before the trade winds; and with some of the same mighty beauty of an express train roaring past a junction.

A bomber of the same type on the ground is shapely, of course, but it seems ungainly. Its fin is too big, its belly droops, and its nose points at the sky rather pathetically, as if it is held down against its will.

As you fly over it you get the impression of seeing some giant insect pinned down to a collector's board. You watch it taxi across the airfield to the runway and it seems to be a live crawling thing, moving slowly and painstakingly, held back by some invisible power.

You look at it again from the ground, and you get an impression of power and awkwardness. You will agree perhaps that on the ground an airplane is completely helpless. Robbed of its speed, it is at the mercy of bomb and bullet. It cannot protect itself. Without space it cannot take the air.

It is still like an animal, a prehistoric monster, like the ones you saw brought to life in a Disney movie, but not quite. Then you get the idea that in some ways it is like a seal or sea lion. They flop and wobble and slump in grotesque attitudes. But once they are in the water, how they change! They become poems of floating grace. They carve exciting arcs out of the green water. Speed in the water gives them new life. Look at the bomber again, and you begin to

understand. Speed gives it life. Once it is in the air, it takes on its real personality. It is in its element—a thing of beauty, a joy to behold, a tremendous tribute to the men who designed and built it.

You can think, too, that this handsome knight of the air is a national hero. He has more glamor than a movie actor, more guts than the toughest screen he-men. He is the product of many brains, the result of the work of thousands of skilled fingers. He has a pedigree longer than that of the finest of race horses. In his make-up are some of the qualities of the fighter plane, such as speed and armament. He has the range of the big passenger planes of prewar days, the toughness of a destroyer, and he can haul the load of a super delivery truck faster than any land vehicle can travel. He can drop a bomb heavier than the largest shell in use, with double the accuracy of the long-range gun; he can reach a target hundreds of miles beyond the range of the longest-range gun ever made. He shoots down enemy fighters, flies faster than they do, often at high altitudes. He roars through the sky at better than 300 miles per hour and lands in about the space required for a fast single-seater ten years ago. He has a skin of steel that nothing but the heaviest bullets can pierce, and he packs a heavy wallop himself, anything from ten to thirteen machine guns and cannon.

The men who fly it make up the heart and brains of the bomber. They are a combat crew ranging from two to ten men according to the size of the plane. The combat crew of a bomber such as the Fortress or the Liberator are trained first as individuals and then as a team. Teamwork is their business. Each is a specialist at his own particular job, each knows something of the other man's work so that if his comrade is knocked out he can pinch-hit for him, and help the team come through. Often during the bitter fighting over France and Germany the bombardier of a Fort or a Liberator has brought the monster safely home after the pilot and the co-pilot have been killed or seriously wounded.

These bomber crews are the human factor of the air forces. To quote General Henry H. Arnold, Commanding General of the United States Army Air Forces: "It is as men—not as heroes—that they have to fight this war. It is a dirty war, as dirty as any. Heroes or not, our men have done heroic things. Privates, sergeants, generals have put their lives on the line—not without regard for the consequences, as some like to think—but knowing full well what the odds were. . . . They pit their flesh, skill and steel against the

flesh, skill and steel of the enemy. It is they who are fighting this war."

The crew of a big bomber consists of a pilot—the captain of the ship—a co-pilot, a navigator, and a bombardier. These are usually commissioned officers or flight officers, the new warrant rank created by the Army Air Forces. The pilot is responsible for the ship at all times and for crew discipline. At one time only during the flight does the captain take orders, and that is for the run over the target, when the bombardier has complete command, and gives orders.

Other crew members are gunners, radio and flight engineers, who also double up as waist gunners. The tail gunner, known as "Tail-end Charley," is the man who gets the most glamor and public notice. He has a rough cold job, but the ball-turret and top-turret gunners do their share too, and many an enemy plane has been shot down by the waist gunners who may be the flight engineers, or the spare man of a combat crew, such as the photographer whose job is to film the flight of the bomb as it leaves the bomb bay and falls towards the target.

There is another member of the crew too, a silent, mechanical man whose work is of inestimable value. This is the auto-pilot which flies the ship on its course, thus saving pilot fatigue, and which cooperates with the synchronized bombsight that has made American high-altitude bombing the most accurate in the world. You would hardly notice this master magician of the air if you were looking at the insides of a big bomber, but it is all-important to the functioning of the big ship.

The electronically controlled auto-pilot actually transforms the plane into a steady platform from which bombs can be dropped. It differs considerably from "George," the peacetime automatic pilot. It is self-correcting to a minute degree. When coupled with the bombsight which itself consists of two gyroscopes, one moving on the lateral, one on the vertical axis, the super-sensitive electronic mechanism returns the plane to its course regardless of cross-current, wind variations, and blasts of exploding flak. It can also be used to enable the plane to take evasive action.

Another advantage of this wonder instrument is that it allows the installation of control stations in various parts of the plane, so that if the main controls are damaged by enemy action, the plane can be flown from the center or even the tail area.

One example of the auto-pilot's efficiency was recently revealed by the War Department, in telling of a Flying Fortress that was almost cut in two when rammed by an Me-109 fighter plane. The pilot's control cables to the rudder and elevators were severed. With such defects a plane could be expected to crash out of control, probably with the entire crew, there being no time to bail out. The auto-pilot, however, brought this ship safely back to its base, the control surface motors of the electronic system being located in the tail. In another instance a B-24 flew for 2000 miles after its crew had bailed out.

You will notice in inspecting this flying battleship that there seem to be machine guns everywhere. These heavy .50-caliber rifles point from turrets and gun ports in every conceivable direction. The big wide fuselage is in reality a fort. There seems to be a gun ready every way you turn. There are guns pointing ahead, guns sighted to the rear, guns on each side. Underneath there is a tiny compartment where a man sits curled up in a little glass "office" which is a gun turret. The turret itself, electrically controlled, is one of American industry's modern marvels. The gunner operates it with his feet and his hands. It will turn in any direction he wishes. He goes with it. The mechanism is hair-trigger sensitive, but as tough as the other components of the plane. The gunner can swing his guns at finger pressure in the heaviest slip stream, and hold his aim at will. If the electric mechanism fails, he can operate his guns by hand. His weapons are the best of their type ever taken into air. He has a wonder-sight that absolves him from all responsibility except the actual sighting. This is the Sperry computing sight.

To appreciate the wonder of this device, you have to understand the problems facing the aerial marksman. Many people think that anyone who is a good shot on the ground with a sporting rifle will make a good aerial gunner. Nothing is further from the truth. We'll admit that if a boy has learned to use a bow and arrow, and a small gun, and can hit a moving object at twenty-five to fifty yards, he will have some idea of the rudiments of marksmanship, but guess-work is not enough in modern aerial gunnery. Too many dimensions and elements have to be considered. The gunner's problem is to arrange for his projectiles to arrive on the enemy's line of flight at the moment the enemy plane will be there. To achieve this he needs to know the speed of the enemy plane, and the direction of its flight. In sighting he must also allow for the speed of his own plane, and its line of flight. In some instances gunnery may be simple. Aerial

gunners endeavor to reduce the angle of deflection by getting on the tail of the enemy plane, the oldest practice in aerial gunnery. Fighter plane pilots, however, are taught never to fly in a straight line while hostile planes are in the area, and to approach a bomber flying on a broken course. Actually the enemy fighters come in to attack in a series of sweeping downward curves, often diving at a speed of 400 miles per hour or more. At such a speed they give the gunner little chance to draw his sight on them and get a burst. Being a bigger plane, the bomber itself is at the disadvantage of offering a larger target area to the fighter than the fighter gives to the bomber's gunners. Unless he can predict the right spot at which to aim his bullets, by calculating the speed, course, and range of the enemy fighter, the bomber's gunner is not able to do any effective shooting.

He has another problem too. Unless he is firing dead ahead or astern of his line of flight the trajectory of his bullets will retain the forward motion of his plane. In practice, therefore, he allows for this and aims at an imaginary target area where he thinks the enemy plane will be when the bullets reach it. With the old ring sight, skill in this kind of shooting was a matter of long and constant practice. A gunner in a plane flying at 300 miles per hour on a straight course, making a deflection shot at a plane flying parallel to him, has a simple task. He aims ahead of the target allowing for the forward motion of the plane, and if his allowance of lead ahead is sufficient the enemy will fly into the bullets. But supposing the attacking fighter is coming in close at high speed. To score a hit he must aim behind the fighter, because his bullets have a forward (sideways) speed of 300 miles per hour which means that they will travel on a short diagonal course. To make such a shot with the ring sight demands superb judgment and split-second timing.

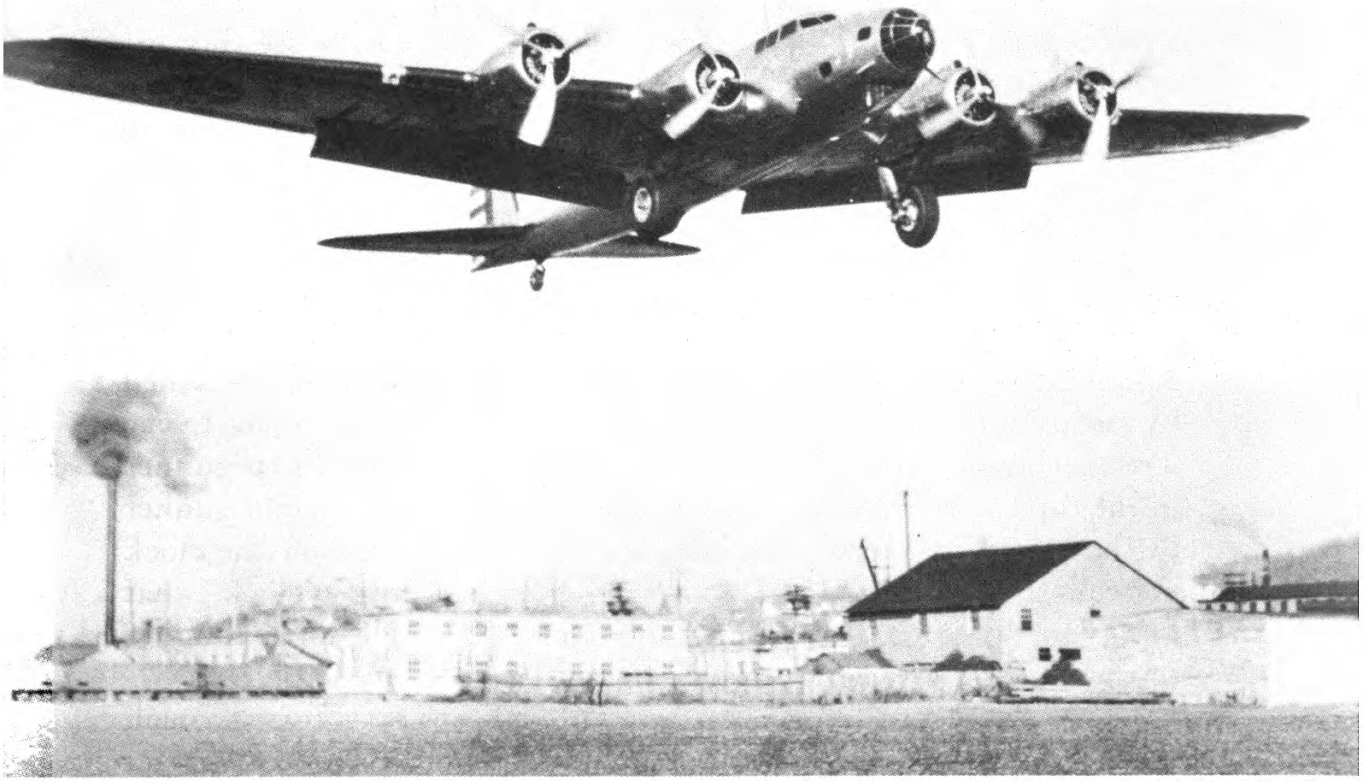
The Sperry computing sight makes aerial gunnery almost foolproof. All that the gunner has to do is to frame the enemy plane between two cross hairs on a ground-glass screen. This automatically gives the range of the enemy plane. Holding the plane in the screen he follows it across the sky. The instrument immediately calculates the speed and course, and corrects the sighting mechanism, so that with the enemy plane full in his sight the gunner only has to press the trigger. The use of this sight has been of inestimable benefit to United States combat crews, an instance of its effectiveness being the January, 1943, raid on Kiel in which ninety-five enemy fighters were destroyed.

Since the beginning of the war the U.S.A.A.F. have steadily increased their record of shooting down enemy planes from bombers. Each combat crew member is a trained gunner. He is shown how to use his gun, how to keep it in repair, and is given ample opportunity to practice shooting. In combat he is disciplined as to the field of fire, or area of sky allotted to him. He must not under any circumstances attempt to shoot outside that field. If the "bandit," as the flying doughboys call the German fighters, passes out of view, he tips off the man into whose sights the plane is going. When attacked by enemy fighters the plane crew goes into action as one man. Every word spoken by any crewman is heard by the others. The gunner in the top turret usually acts as lookout to the front, the tail gunner to the rear. They report the position of enemy planes on the clock system. If the tail gunner reports a bandit at "four o'clock" that means to the starboard side of the plane at an angle corresponding to the position of the figure four on the dial of the clock.

During the action the pilot or co-pilot keeps in constant touch with the men on the interphone, for two reasons—morale and security. After every swooping attack by a fighter, the pilot will inquire, "Everyone O.K.? Answer in sequence." Each gunner then reports damage to himself or to the machine, his success or otherwise in beating off the enemy.

When a big bomber is attacked by enemy fighters many minor injuries can be inflicted without the pilot or co-pilot being aware of them. The tail gunner may have been rendered unconscious by having an oxygen lead severed. The waist gunner may have been clipped by a bullet, the control conduits damaged, a fragment of stressed skin may be ripped from the tail. Everything must be checked and reported immediately. In the case of wounds crew members give first aid on the spot. If the wounded man occupies a vital position, he is removed to the waist of the machine, and another takes his place.

In the early days of action over the roof of Hitler's fortress Europe, United States combat crews suffered many crew losses through enemy machine-gun fire and flak. Bombers often made their way home with crew members dead or dying, although the machine itself was little damaged. The United States Matériel Command quickly applied itself to the problem of giving the maximum protection to bomber personnel, and today the men who man the Forts and Liberators wear armor-plated flak suits, somewhat resembling the armor worn by the knights of medieval times. These



(Above) The Army based its initial order for thirteen Flying Fortresses on this Boeing YB-17. *Boeing Airplane* Co. (Below) From these early B-17's have come today's war-proven Forts, one of which is shown winging toward its home base after blasting Jap installations on Gizo Island in the Solomon. *U. S. Navy—Acme.*

A gun-bristling Fortress heads for home after a raid on Marienburg, Germany. Far below can be seen a graphic example of precision bombing. *U. S. Army Air Forces.*

suits made of steel plates and mesh covered with fabric will stop shell splinters and bullets. They have already saved many valuable lives. They add weight to the machine, of course, but the authorities consider the extra cargo well worth while.

The suits are so constructed that in the event of the wearer having to bail out, they can be easily discarded. Two types of steel helmet are used by bomber crews, one with a visor for the gunners, and a simplified one for the pilot and co-pilot. Both follow closely the design of the ancient helmets worn by the pikemen in the days of Good Queen Bess.

In actual fighting equipment the United States bomber is second to none. It has blazed a trail through the battleskies and demonstrated for all time that daylight bombing can be made a practical and efficient military arm. It has proved that bombers can defend themselves against fighter planes; it has, in fact, to quote *Flight,* the leading British aeronautical magazine, "wiped the noses of the fighter planes."

Heavy bombers are the long-range heavy artillery of an army. They are designed to carry heavy loads of bombs, usually at high altitude, to attack enemy industrial centers, rail junctions, and ports. They are used for strategic bombing, as compared with the tactical bombings of medium and light bombers.

American heavies differ largely from British in the matter of load and range. The British built their four-engined Lancasters, Halifaxes, and Stirlings for a certain specific purpose, to carry the heaviest possible bomb load over a maximum round trip of 600 to 700 miles, which means that the entire German industrial area is within range of British-based planes. As most of their raids were to be undertaken at night, they concentrated on useful load above everything else, with speed and range a secondary consideration. The Lancaster can carry eight tons of bombs to Berlin. The American B-17 Flying Fortress can carry a much lesser load of bombs twice as far as the Lancaster, at 30,000 feet, and at much greater speed. The Liberator, the most modern bomber design in use by any air force, as we shall see later, can carry a greater weight of bombs over the same distance as the Fortress. If used for short-range work such as the Lancaster, it can carry up to ten tons of explosives at a greater speed than the British heavy.

As a weapon of war the bomber is unique. It can go places that are denied to surface battleships, tanks, and armies. It has sunk battleships and battered fortifications. It has smashed oil wells, and

devastated docks and industrial installations; it has rescued men from seemingly impossible situations, and has carried thousands of seriously wounded from the shadow of certain death to the reality of life under expert medical care.

When you see that big bomber rumbling overhead through the trackless skyways you may like to think of its past, and its future. It was born in the brain of man, committed to paper, and made into a model or mock-up. Thousands of men and women, and hundreds of industries have united to bring it to reality. People who made your kitchenware, your piano, your electric toaster, your sister's girdle, mother's silk stockings, and even dad's pipe cleaner have united to provide materials for this mighty weapon. Into it have been put many devices that will benefit you in the future, electronics, plastics, radio and television. Its engines burn a gasoline that will make your automobile run more economically and with greater power. See it, perhaps, as a proving ground for the future as well as a weapon of victory.

Chapter Three

THE FLYING FORTRESS

WITH bombers as with all machines, the rule is—first decide what you want the machine to do, and then allow the designer to build it with that purpose in view. If Britain had had a thousand long-range day bombers at the beginning of the war, she might be worse off than she is today, when she is using bombers built for the purpose her air chiefs had in mind in 1936, when they began to think of bombing again. Similarly, if the United States had had to rely on the Lancasters in the Pacific, the air war might have taken a very different turn, for the big bombers would not have been capable of achieving those shining exploits that now spangle the honor shield of the United States bombardment squadrons.

If you were to ask me for an accurate description of the B-17, I

would call it a flying battleship, rather than a bomber. The Flying Fortress was designed to be exactly that. As a flying battleship, it has distinguished itself wherever it has been in action. As a high-altitude bomber, carrying a medium load of bombs, it is the ace of the war skies.

The Fortress has borne the brunt of America's air offensive in this war. It has probably had more publicity than any other bomber and every word of it has been merited. When war broke out, General Arnold, who commands the United States Army Air Forces, said that the B-17 was "the guts and backbone of our world-wide aerial offensive." He added that it has no equal in the air.

Behind every successful plane there is a definite idea coupled with good basic design. Most of the planes of the United States are civilians in uniform, and the Boeing Fortress is no exception. It comes from a famous family of warplanes and passenger planes. The name Boeing was first heard of in 1916, when William Boeing, in his one-room shop in Seattle, built a plane to carry mail.

From that small beginning have come many famous planes which give the Fortress an interesting pedigree. One of these planes that played a big part in the creation of the Fortress was the Boeing Monomail, the first of the low-wing monoplanes of all-metal construction. The Monomail operated on the Boeing Air Transport route. It carried five passengers and 750 pounds of cargo at a speed of 140 miles per hour, which is quite fast when you consider that the Monomail appeared in the beginning of the 1930's. The Monomail was actually a single-engined bomber. Boeing's, which had produced a pursuit plane for the Army which was a sensation in its day, built the B-9 as the first twin-engined all-metal bomber. It was sometimes called the "Flying Pencil" because of its long, slim fuselage.

The B-9 was the fastest machine for its weight in the air. From it the Boeing engineers developed a twin-engined passenger plane that was the nearest thing to a Pullman car with wings. This fitted in admirably with Ernst Udet's quip at American planes—that they were made "to live in," while the Germans designed planes to fight in.

Boeing engineers learned a great deal from the slim, deadly B-9. Already they were looking at the vast horizon ahead. There seemed no limit to the size of an airplane. They could build a bigger and better bomber. With their increased knowledge of aerodynamics and with the availability of more powerful engines, there was no

reason why a bomber should not be able to outfly a fighter plane, faster and higher.

Military thinkers had advanced little from the days of World War I, especially in regard to bombers. People remembered the De Havilland 9a Liberty two-seater bombers that had battled German pursuits in the war skies of Europe, and the lumbering night bombers built by the British and Germans. The pursuit ship, or fighter, as we know it today, was the bomber's enemy. It could outfly and outmaneuver a bomber, and consequently the bombers, if flying by day, would have to be protected by squadrons of fighter planes. The astonishing development of speed in passenger planes gave Boeing designers the idea. What if they could give a big bomber the speed of a fighter, and greater altitude! What if they could give it a range that would enable it to fly across the American continent nonstop?

The importance of the last item cannot be overestimated. America is a vast country. Her long coastlines might be attacked at any point. To meet such an attack, which would certainly come by sea and by seaborne aircraft, the United States Army needed such a long-range aircraft.

It was in 1934 that the Boeing engineers decided to put their dreams to paper. They decided that the United States Army must have a big bomber which would serve it as the battleship served the Navy. It was a bold conception, the first glimpse of the war of the future. The great bomber was to be able to fight its way through enemy skies like a battleship and to maneuver in squadrons, to undertake precision bombing, to undertake long journeys. Its captain and crew would live aboard like the crew of a ship. It would fulfill predictions of many prophets, particularly that of England's late Lord Kitchener of Khartoum, who in 1911 looked forward to the day when airplanes would fly in formation and fight prolonged battles over enemy territory.

In those days few people in America were thinking of ever going to war. The Army Air Corps was practically the same strength as it had been at the close of the last war, and there was little demand for military planes. Boeing designers, however, were convinced that they had something. They talked to the Army and found receptive ears. What they said amounted to this: "We can build an all-metal, four-engined bomber that will outfly and outclimb any current pursuit plane you can send up against it, and it will still carry more than twice the load of a twin-engined bomber."

When people who know talk like that, they usually have sound

justification for what they say. Such a suggestion coming from a nonaeronautical mind, however enthusiastic, might have been rejected. It did seem that the Boeing people were certainly sticking out their necks. All airplane design, you must remember, is a matter of compromise. The man who builds a bomber thinks in terms of weight lifting first, then speed and altitude. The fighter plane's designer thinks in terms of speed and altitude. To expect a fighter to be a bomber, or a bomber to be a fighter, is asking too much.

Boeing's, however, had good basis for their confidence. They had built the fastest pursuit planes and excellent bombers. They had an impressive line of long-distance airliners to their credit.

The first model of the B-17 crashed during a test flight, after doing a 2000-mile stretch at an average speed of 250 miles per hour. The crash was due not to structural defects, but to the inadvertent fixing of the elevators which prevented the pilot from controlling the machine at take-off. This did not discourage the designers. Their next model, put on test, did everything they had claimed for it. It flew faster and higher than any existing bombers and showed its tail to Army pursuit planes. Added to this, it handled as easily as a smaller plane. Army pilots were soon throwing the big giants about and demonstrating their maneuverability. The Army liked the new Fortress and placed an order for thirteen, which immediately began to break air records.

One by one these records piled up. The new aerial giant was making air history. An East to West transcontinental record of twelve hours and fifty minutes was established. Six Fortresses flew from Langley Field to Buenos Aires. Fortresses flown by pilots of the United States Second Bombardment Group flew 1,800,000 miles on their test period without mishap. Later models of the Fortress captured several international records. One carried 31,167 pounds of payload to 8200 feet; another carried over 4000 pounds for 3107 miles in just over eighteen hours, and still another reached 34,025 feet with a load of 11,023 pounds, taking the record from the German Junkers company. A still later model on delivery flight averaged 265 miles per hour from California to New York at a height of 26,000 feet.

The design was justified!

The first Boeing four-engined bomber was known as the 299. This was followed by the B-17, which was replaced by the B-17A, an experimental model. From this was evolved the B-17B of which thirty-nine were built for the United States Army, between July,

of armament and armor plating for crew protection. The first B-17's to see action in the Pacific after Pearl Harbor were short many essentials, but as swiftly as the combat reports came in, Boeing engineers began their improvements. The most important addition was a stinger turret in the tail, with two .50-caliber guns; then a power turret was fitted to the top of the fuselage in front, a new type of revolving turret was fixed underneath, and a series of gun ports were arranged along the length of the fuselage to enable the radio operators and flight engineers to help the gunners beat off enemy attacks.

Other improvements were the fitting of self-sealing tanks, more powerful engines, and the huge dorsal fin which is a distinguishing feature of the new B-17F. There were other modifications too, ranging from the new Plexiglas nose to the exhaust dampers for night flying. The present model is said to be 50 per cent faster than the first, but it weighs an additional seven tons.

The latest model Fortress, known as the B-17G, is the most heavily armed of all. In order to meet the threat of frontal attack by fighter planes, which caused the loss of a large number of the big bombers on operational flights, a chin turret with two additional .50-caliber guns has been fitted. This turret is operated by remote control, and is a useful addition to the bomber's armament. The normal bomb load remains the same, about three tons, but by the addition of two bomb racks fitted under the wings an additional two tons of bombs can be carried. It should be remembered, however, that this extra weight entails sacrifice of fuel, and an exceedingly long take-off run.

There is one type of Fortress, however, which we only hear about from the Germans, who complain indignantly over their radio of American bombers being used as flying flak-ships. These bombers they claim carry no bomb loads, but devote their cargo capacity to ammunition. They are equipped with an exceedingly numerous quota of guns, and fly on the outside of the bomber formations from where they pour an astonishing volume of fire power at attacking fighters. "Our brave fighter pilots have a new problem," said a German radio commentator. "They are called upon to attack planes which look like bombers but are in reality four-engined fighters, their fire power making the attack extremely hazardous."

Goering recently paid an unconscious tribute to the value of United States precision bombing in hindering German war production. Up to the fall of 1943 the German fighter pilots had made a practice of concentrating their attacks on the out-riding members

of the Fortress bomber formations. Their tactics were to cripple a Fortress, and cause it to straggle out of formation, and then knock it off. Goering recently issued orders to the effect that this practice must stop. The Luftwaffe fighters are to attack the main formation and prevent the bombers from reaching their targets. Any flier who attacks stragglers will be removed from his squadron and sent to the Russian front as an infantryman. The reason for the order is clear. Goering knows that one bomber shot down out of a formation cannot stop a bombardment attack. Downing that single bomber, though, may use up the ammunition of an entire fighter squadron which might more usefully be engaged in breaking up the main formation in its flight to the target.

The B-17G is probably the last of the Fortress types, its successor being the new B-29 super-bomber, complete details of which are a secret.

Bomber design, backed by the immense resources of this great industrial nation, ages quickly, and whether we have a B-17F or a B-17L, the models are always a little out of date by the time they see action in large numbers. According to Colonel McDaniel, Commandant of the United States Army Air Forces' four-engined training school at Hendricks Field, Florida, our aircraft factories will soon be turning out a bomber so huge that the Flying Fortress will be used as a transition training plane. Add to this that General Arnold spoke of the Fortress as the last of the small bombers, and we get some idea of what Uncle Sam is planning for the immediate future.

It is unlikely that any bomber, however, will measure up to the exploits of the doughty Fortress, which from the time it drew first blood under British colors, until the last of its models flies in the war skies, will continue to cover itself and its crew with glory. The name "Fortress" is now a legend.

When the Japs struck at Pearl Harbor, the United States Nineteenth Bombardment Group was faced with the task of hitting back. Many of their machines had been damaged. They had to operate over great distances, working from emergency airfields, and battle against every inconvenience that can beset fliers. The Fortresses of the Nineteenth Bombardment Group were soon to make history.

The first exploit of one of these old-model Fortresses was when Captain Colin Kelly's bombardier, Meyer Levin, sank the Japanese battleship *Haruna* from a height of 18,000 feet. Levin had only

three bombs in his bomb bay but he managed to score one hit and one near miss, which did damage sufficient to leave the Jap's battleship sinking in flames.

Details of the work of Fortress pilots and their crews were scanty in those days, but the Japanese paid a striking tribute to the flying battleship, which must have caused Boeing designers to smile. Shortly after the outbreak of war, a Jap announcer issued a warning to pilots that "the American B-17 four-engined fighter was an extremely effective weapon."

These early Fortresses, as we have seen, were not as well armed as their descendants. One morning in 1941, shortly before Christmas, Lieutenant Hewitt Wheless was piloting a B-17 which was attacked by eighteen Jap Zero fighters. The Zeros evidently thought that the Fortress was an easy prey. They came in to attack in formation, and the Fortress gunners were ready for them. After a short sharp encounter, six of the Zeros were shot down in flames. The others broke off the encounter. When Wheless and his men got back to their base, there were over 1500 holes in the plane.

Everywhere the Fortress bombardiers were demonstrating the accuracy of American daylight bombing. Captain H. C. Smelser, pilot of a Fortress, was searching for a Jap convoy off the Philippines when he was attacked by Zeros. "We were cruising over the sea at about 4000 feet, when tracer bullets suddenly began to dance all around our plane. While the boys were shooting it out with them, I ducked into some clouds and then climbed to about 15,000 feet. When we broke clear of the clouds, there below us was the most perfect target I've ever seen, a Jap convoy of thirty ships, escorted by four warships, lined up two abreast and hardly a ship's length apart. As they were heading directly into the light, they couldn't see us coming up behind them. I desynchronized my engines and Lieutenant Marion Wheeler, the bombardier, gave me the directions for our target run.

"As we came over them, Wheeler planted eight 600-pound bombs smack in the middle of the column of ships. There were six ships sinking before we left. If we had had a few more B-17's, we could have wiped out the whole convoy in two minutes."

Captain Smelser afterwards referred to Lieutenant Wheeler as "the best bombardier in the Pacific." To the six ships in that convoy Wheeler bracketed a heavy cruiser off Bali, and destroyed two transports in the Macassar Straits at 27,000 feet.

Stories of Fortress exploits in the Pacific began to come in rapidly. It was a Fortress that evacuated General Douglas MacArthur and

his wife and son, with President Manuel Quezon, from the Philippine Islands to Australia. B-17's took part in the battle of the Coral Sea, along with Navy dive and torpedo bombers which were attacking the Jap fleet from low altitude. Then came the Battle of Midway, in which Fortresses and Liberators sank at least three Japanese carriers and scored a decisive victory over Jap sea power. Commented General Arnold: "The Fortress has no peer in its field today."

Colonel Walter C. Sweeney, Jr., of San Francisco, leader of a squadron of B-17's, took them in three attacks during the Midway battle. He reported that pilots of the Japanese ship-based fighters did not press home their attacks on the Fortresses, with the result that not a single one of his squadron was shot down, although in one attack his gunners disposed of three and possibly four Zeros. Jap pilots obviously feared the fire power of the Fortresses. They usually made one pass at the big bombers from below, fired a few shots, and then rolled over on their backs to break action. Some of the Fortresses were hit by antiaircraft fire, and several of them came home on two engines. Said Colonel Sweeney of the battle: "These big bombers will win the war."

By the time the war is through, the battle honors of the Fortress will probably fill several books. They have featured in practically every major air battle that has taken place. General MacArthur sent Fortresses to attack the Jap fleet based at Rabaul in August, 1942. All returned, with a score of seven enemy fighters known to be knocked out. The Japanese have met Fortresses in the Aleutians, but the toughest battles in which they have participated have been in the icy skies over German-occupied Europe.

Daylight raids on Europe were exceedingly rare when the first B-17's dropped their wheels to land on Britain's airfields, which had been hurriedly prepared for the new giants. The R.A.F. could only use its heavy bombers for daylight raids when the mission was of the greatest urgency, such as the Lancaster raid on Augsburg. A big bomber unprotected by fighters was thought to be easy meat for the deadly FW-190's and Me-109's with which Goering was policing the airlanes to the Ruhr and to Berlin. No bomber, however fast, however well-armed, could expect to stand up against the assaults of these machines!

There was some wonderfully careless talk at the time on the project. Writers whipped up a controversy. Some went so far as to say that American bombers were totally unsuitable for the task

ahead of them, and the British were reported as having given friendly advice to General Eaker, then in charge of the United States Bomber Command in England, to this effect. All kinds of arguments were produced, and many of them by people who had never been nearer to a bomber than seeing its picture in a newsreel. While Fortresses had been successful against Japanese Zero fighters, with their thin skins and light armor they would have no chance against the heavily armed German fighters. Jap Zeros had small caliber bullets, clamored the critics, while German fighters had cannon shells. They would simply murder the Forts. It would be suicide. Even with their thirteen .50-caliber guns, continued the talkers, the B-17's would not have a dog's chance of warding off the German planes. If several fighters went after a Fortress, it would be as good as lost.

Those who believed in the Fortress said little at the time. They remembered, perhaps, that the Fortress had four engine lives as against the one of the fighter plane, that it had two or perhaps three pilot lives, and that it had a fire power of four foot pounds per minute. They reflected too that a squadron of twelve Forts could put up such a terrific protective cross fire that by all laws of ballistics nothing that flew could come through it still flying.

For weeks the words raged, and armchair air tacticians were shooting each other down with bitter shafts. Then in August, 1942, General Ira Eaker led the first all-Fortress raid against Rouen. Said an R.A.F. man who was present when the four-motored giants soared away from the airfield: "It was the tensest moment I can remember. I had the same horrible feeling as when I saw my first bull-fight in Spain. A bull-fight is the most nauseating exhibition you can imagine, but no one who sees it can resist succumbing to the terrific suspense, when he realizes it is the man—or the bull. I felt rather that way. Would any of those Forts come back? They really did look like 'Flying Targets,' you know!"

The B-17 formation was screened by squadrons of Spitfires and Hurricanes. At 25,000 feet, the pilots saw Rouen shimmering in the summer air beneath them, through gaps in the huge wads of cotton-wool clouds. The bombardiers took over; the gunners crouched waiting at their guns. Down went the bombs, up came the tell-tale plumes of smoke, showing in such regular patterns that the target area looked as if it had been planted with rows of giant white-flowering shrubs. "It was like dropping apples in a barrow," said one bombardier.

Then came the trouble. A cluster of yellow-nosed Focke-Wulf

190's, Goering's crack fighters, came boring out of the upper skies. Some of them pierced the screen of R.A.F. Spitfires, and headed for the massive invaders, their cannon and guns spitting and belching. An American sergeant in one Fortress got one of the Focke-Wulfs in his sights. He pressed his trigger and the fighter dissolved in flaming fragments.

Gunners of the other Forts opened up also, and the Spitfires chopped at the remainder of the German formation, losing two of their number in the process.

General Eaker, flying in a Fortress named *Yankee Doodle*, led his squadron back to the airfield intact. There were bullet holes, and some wounded men, but no losses. As Air Chief Marshal Sir Arthur Harris, head of the R.A.F. Bomber Command, said in his telegram of congratulations: "Yankee Doodle went to town and can stick another well-deserved feather in his cap."

Other raids followed. In each the American heavies proved they could hand out severe punishment. Twelve Fortresses returning from one raid were attacked by twenty FW-190's. The Fortress gunners were credited with shooting down four of the enemy fighters and damaging ten more. All the Fortresses returned safely, although one was severely damaged.

This was the last bomber in the rear of a V formation. Nine Focke-Wulfs swooped on it and poured a damaging burst of fire into the cockpit. One shell wounded the pilot and killed the co-pilot. Another ripped a large hole in the fuselage, while another burst knocked out one of the gun turrets. The bombardier happened to be a "washed out" aviation cadet, who had got as far as advanced pilot training. He managed to remove the wounded pilot from the controls and flew the machine home to make a perfect landing, thus demonstrating the "nine lives" of the Fortress and his own American courage and resourcefulness.

Meanwhile the aviation world held its breath. Were the Forts impregnable or were they just having abnormal luck? On the thirteenth raid undertaken by the big planes over France, Fortress gunners bagged thirteen Focke-Wulf and Messerschmitt fighters. Thirteen raids without a single machine lost, thirteen fighters down. It only needed to be Friday, the thirteenth, to complete the circle.

But the German fighters were licking their wounds and planning how to down these Boeings. They probably worked on the theory that no machine is impregnable and impervious to heavy fire power. The vulnerable spots of the flying battleship were obvious: the

pilot's cabin, where a well-placed explosive shell might kill the pilot, the co-pilot, and the navigator, destroy the gasoline tanks, and the pipelines to the engines. To hit them was a problem! Getting in close was essential, but how to avoid the devastating fire of those .50-calibers? The Germans well knew that the Fort was a veritable porcupine of fire. To attack it from the tail, normal procedure for dealing with a bomber, was useless. If the tail gunner didn't get you, the top gunner might, and you would run the risk of being ripped with bullets by the waist gunners, in their improvised gun ports.

In one quarter only, the fire power of the B-17 was limited. The arc of sky immediately ahead and above the line of the leading edge of the wings. With this in mind, the Germans evolved their new tactics. Why not attack the bombers in the front and from above? Pilots were instructed to dive head-on at the bombers from a steep angle, and then execute a half roll and remain on their backs, still diving. At the moment his machine was upside down, the pilot would open fire, aiming either at the pilot's "office" or at the engines. The conception of this maneuver was brilliant. While executing it, the fighters would present the least possible target to the Fortress gunners: first their frontal silhouette, next the same reversed; then as the machine continued its dive, only the slim belly of the fuselage. That the Germans respected the marksmanship of United States gunners is shown by the fact that they fitted specially heavy belly armor to the fighters assigned to destroy the Forts.

When you realize that the fighters were diving at over 400 miles per hour, and that the forward speed of the Fortress would be in the neighborhood of 300 miles per hour, you get an idea of the problem presented to the American gunners by this method of attack, especially since the Germans' attack was made at such a difficult angle. The advantage was all on the side of the German fighter planes. A light fighter coming toward you at an angle, say one o'clock in fliers' parlance, at 400 miles an hour (plus your own forward speed), moving in two directions at once (rolling on its lateral axis as well as going forward) presents an almost impossible target, and a small one as well. The FW-109 is only 29 feet long and has a span of 34 feet, 5 inches. On the other hand, the Fortress, which measures 103 feet, 9 inches from wing tip to wing tip and is 73 feet and 9 inches long, is a comparatively large target, particularly when on a course of level keel. The Germans certainly used their brains to best advantage.

On October 9, 1942, the B-17E's made their fourteenth raid.

More than a hundred United States bombers, Liberators and Fortresses, escorted by Spitfires, set out to raid Lille, the great industrial center of northern France. The bombers arrived over their target well screened by the fighters and delivered a terrific pounding to the city, dropping some 1300 tons of bombs.

Then came the stiffest test of these daylight battleships. Some three hundred German FW-190's and Me-109's broke through the fighter screen and dived on the bombers like angry hornets. A battle royal ensued. It was each Fortress for itself. Fortress gunners acquitted themselves well, and soon the air was full of tell-tale parachutes. One by one the fighters broke away, some in flames, some smoking, and some slightly crippled.

They came in again and again, and managed to separate two of the American giants. One Fort was in flames; another had fallen out of formation with two engines smoking badly. From another the crew was bailing out; according to crew members of one of its wingmates, "They seemed to fall through a mass of whirling German fighters."

One Fortress squadron leader saved a damaged member of his squadron by reducing the speed of all his planes and forming a convoy around it. The concentrated cross fire put up by the gunners successfully beat off all attacks on the limping plane. When the raiders returned, only four of the big bombers were missing: three over enemy territory, one in the Channel. The crew of the latter were rescued.

The controversy over the value of the B-17's began all over again. The first reports issued by the United States Bomber Command credited Fortress gunners with shooting down forty-eight German planes and damaging nineteen more. The Spitfire escort were credited with destroying five German fighters. This was one of many occasions on which the bombers have registered a higher score than their fighter escorts.

The critics were still not convinced. They hinted that the American gunners in the excitement of the battle were unable to keep an accurate check of the number of machines they had destroyed. Presently new figures began to be compiled, using the proven method of not allowing credit unless at least three people have seen the enemy plane go down out of control. The United States Bomber Command began its inquiry—the final box score was 102 German fighters put out of action for the loss of four Fortresses.

The Germans, however, seemed to have begun to take the measure

of B-17's, and as the raids continued, the loss began to fall in line with the average expectation of machines destroyed on night raids. The Fortresses, however, demonstrated that they could take far more punishment than any other machine in the air, and gradually the great bombers piled up "personal records" that have never been equalled by any type of aircraft.

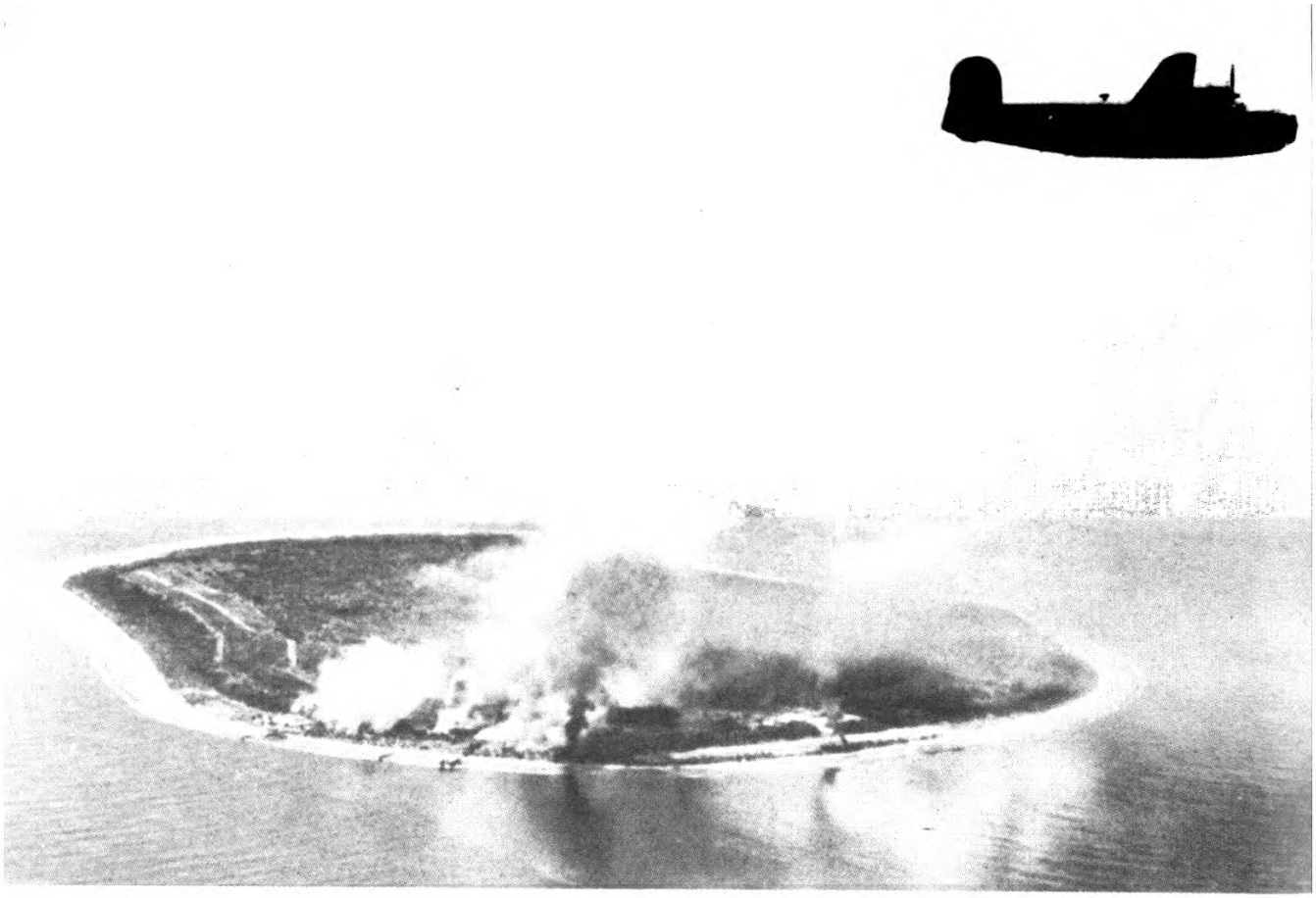
Of course, the Fortress starts with an advantage over the British heavies. Whereas the R.A.F. knows its individual planes merely by letters, the Fortress crews christened their machines with a variety of attractive names. There were *Phyllis, Suzy Q, The Memphis Belle, Hell's Angel, Tilly the Toiler, Dinah Mite,* and a host of others. Many of them will be remembered long after the war is over.

The story of *Phyllis* was cabled round the world. *Phyllis* was one of a squadron taking part in a bombing mission over an aircraft factory in Meaulte, France, when she was attacked by thirty FW-190's on her homeward journey. She was flying at a great height, and all the crew members were using their oxygen equipment. The first burst of Focke-Wulf fire broke the oxygen leads and disabled one of the port engines. The sudden lack of oxygen was such a shock that two of the gunners fainted. The navigator slumped over his table. Lieutenant Charlie Paine, the pilot, still had his senses. He put *Phyllis* into a steep dive so that the gunners would be revived by the lower altitude.

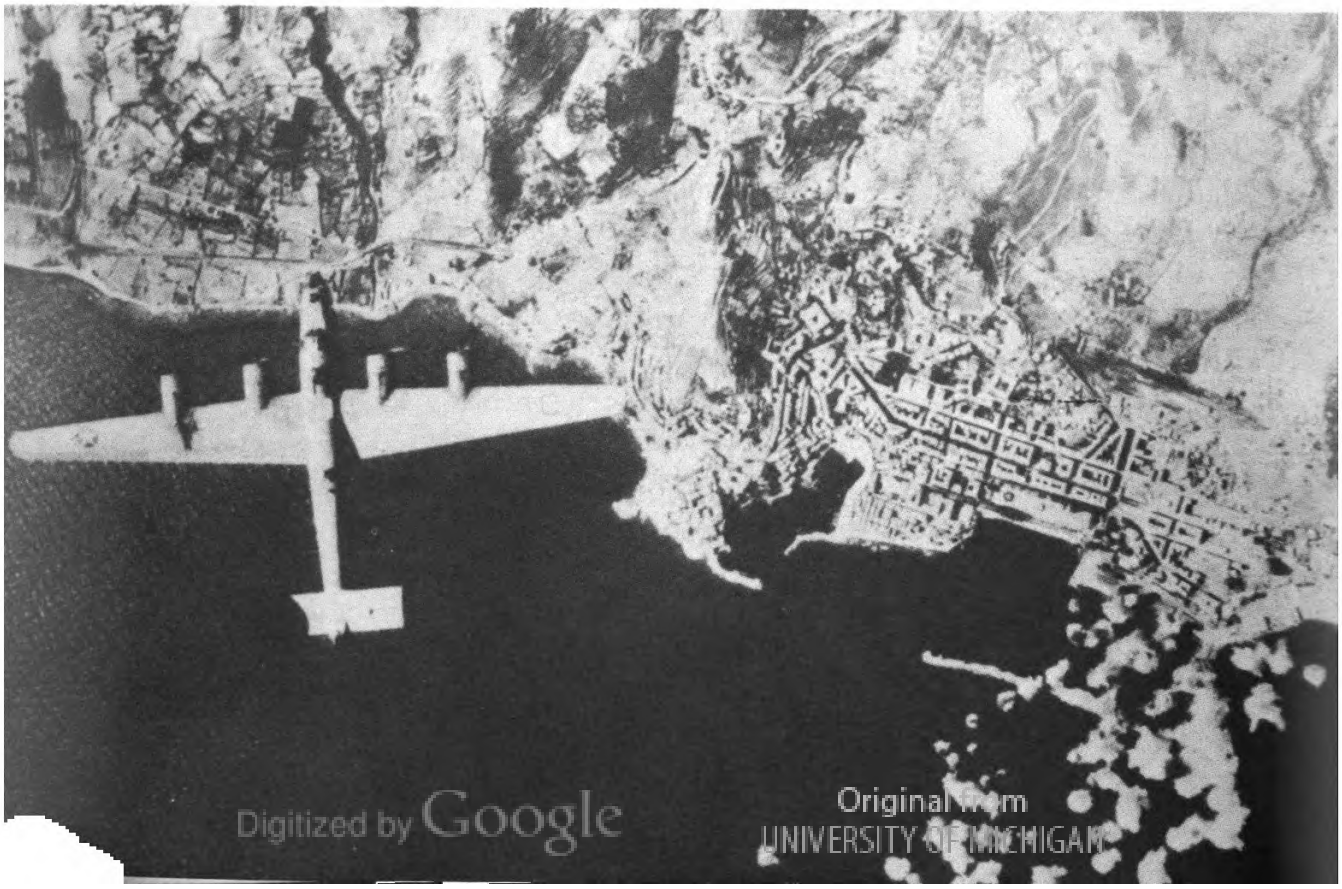
Behind them came the fighters, weaving and twisting like hounds chasing a stag. Ahead of *Phyllis* was more trouble, a solid wall of antiaircraft fire from the ground. Lieutenant Paine did not hesitate. He went right through the barrage with bits and pieces chipping off *Phyllis* and shrapnel clattering against her metal sides. Once through the barrage, the pilot had breathing time. The fighters had made a detour to avoid their own antiaircraft fire. *Phyllis* wasn't feeling so well. She had a gaping shell hole in one wing, and her tail looked as if it had been clawed by some giant bird. (Bent Taucher, the tail gunner, said he was too busy shooting Germans to notice that anything had happened, but when they landed he was seen counting several large holes a few inches from where his head had been.)

Two of her engines were now out of action, and some of the controls had been shot away. The Focke-Wulfs came in again to "worry" her to the death. The gunners went to work each time a German fighter came within range, and let him have it. One of the Germans scored a direct hit on the upper turret. The cannon shell burst just inside, and the gunner, Thomas Coburn, was badly

Against a background of flames and smoke from burning oil, low-flying Liberators pass into the target area at Ploesti, Rumania. *U. S. Army Air Forces.*



(Above) A Liberator bomber hovers over the smoking Japanese island of Nauru. *U. S. Army Air Forces—Acme.* (Below) The harbor and dock facilities at Bastia, Corsica, are peppered with bomb bursts by this Liberator raid. Hits were made on four merchant ships and in the railroad yards. *U. S. Army Air Forces—Acme.*



cut about the head. Blinded with blood he kept on firing until he collapsed and fell unconscious between the two pilots. *Phyllis'* nose kept going up instead of down, and Paine and his co-pilot, Lieutenant Robert Young, had to stand up and lean on the controls with all their strength before she finally responded to pressure.

The German gunners must have been getting angry at her continued resistance. One Focke-Wulf pilot flew in so close that the American crew thought he was going to ram them amidships. Concentrated fire by two of them, however, with their .50 caliber guns, changed that pilot's mind. He went down and exploded a few feet beneath the giant plane he had hoped to finish.

Then came what one of the crew members described as "a glimpse of heaven," the English coast. The Focke-Wulfs quickly turned and made for home. Thirteen of them had been shot down.

Phyllis was now feeling very sick. She had only two engines working, and her landing gear had been wrecked by a direct hit from antiaircraft fire. Her fuselage was riddled with bullets, and as she came over the airfield her pilot found he could not open her flaps. Neither would the ailerons work. Damage to the tail had disabled one of the elevators, and Paine would have to attempt a belly landing. He started to throttle back his two remaining engines and found they would not respond. The first time he came in over the field, *Phyllis* was going so fast that he could not bring her down safely. He pulled her up at the last minute, and the tail knocked off a portion of roof from a building at the edge of the field.

Paine was not to be discouraged. *Phyllis* had brought them home, and he was determined to get her down safely. He made one more try, and a few feet above the ground he switched off the engines. *Phyllis* subsided gently and slid along the ground on her belly. Said Paine, looking at the almost unbelievable damage done the machine by the Focke-Wulfs: "The girl friend certainly brought us through!"

One of the fightingest Fortresses ever to get in newspaper print in two continents was a lady called *Suzy Q*. This member of the Nineteenth Bombardment Group arrived at Boeing Field early in 1943 after flying home from her Pacific base. *Suzy Q* had been in action since the outbreak of war. On her nose was painted an astonishing list of places she had visited, and on her side was a panel bearing twenty-six rising suns, to tell the world that *Suzy's* gunners had knocked off twenty-six Japanese planes.

Along the sides of her graceful fuselage, in her tail, and on her wings were many patches. They covered bullet holes she had received

in battles over the Macassar Straits, Java, Borneo, the Celebes, Rabaul, and New Guinea. *Suzy* had been at war without let-up. She had logged more than 2000 hours in the air and had been hit more times than you could count; yet not one of her crew had been killed or injured.

During an attack on Rabaul, *Suzy* was doing a bit of low flying. Cruising around a few feet above the ground, her pilot spotted a Jap military camp. He decided it needed attention and went in. As the incendiary bombs began to fall, Japanese antiaircraft opened fire from the top of a hill. *Suzy*'s gunners finished off this interruption with a low-flying strafe, and she then turned to cruise over the encampment for an hour or so, completing its destruction.

Some of the tales told of *Suzy Q* are unorthodox for even a well-trained bomber. On one occasion, she ran out of fuel and had to be brought down in a small clearing in the northern Australia bushland. The spot was isolated, and there were no means of assistance near by. The crew went four days without food while they waited for gasoline to be dropped. They filled in time building a runway from which *Suzy Q* could take off after the fuel arrived. It must have looked pathetically small, being only about a quarter of the size usually required for a Fortress take-off.

Lieutenant Colonel Felix Hardison, *Suzy's* commander, headed her toward the sea and opened up her motors with the brakes still on. *Suzy* quivered like a race-horse and then, as the brakes were released, she tore into the air as if shot by a rubber band.

One of *Suzy*'s heaviest tasks was supporting Marine landings in the Solomons. *Suzy,* along with other ships of the Nineteenth Bombardment Squadron, was credited with destroying more than 150 Japanese planes on the ground. During the battle of the Macassar Straits, *Suzy*'s squadron claimed to have destroyed 35,000 Japs in one sortie. Her bombardier is credited with having sunk more enemy ships than any other bombardier in action.

When *Suzy Q* flew back to America, she brought with her a crew which probably at that time carried more decorations than any other bomber crew in the United States Army Air Forces. All of them were recommended for the DFC, and all wore the blue band with oak leaf clusters that meant their group had been cited three times by the Secretary of War and once by the President. Lieutenant Colonel Hardison earned nine World War II decorations while flying *Suzy*. Said he, looking at his battered old plane: "'You know,

there are three beautiful things in this world—a woman, a thoroughbred horse, and a Flying Fortress."

The crew commented: "*Suzy Q* should be awarded the Congressional Medal of Honor. She never failed us. She crossed the Equator four times, and flew thirty-five thousand miles around the world."

One Fortress, or a combination of Fortresses that joined forces under stress of combat, has an equal claim to fame as *Suzy*. His name is *Alexander the Swoose*. *Alexander* was named the *Swoose*—half-swan, half-goose—when in Australia half of the original plane remained intact and a new half was assembled from parts salvaged from other Fortresses. His first half had seen nine months' action before *Alexander* became a *Swoose*. *Alexander* fought in the Philippines, in the Macassar Straits, in Java, in the East Indies, and over Australia. He spent the early days of the war blasting the Japs on land and sea, and he is credited with sinking a number of their warships. The exact score has not been revealed, but *Alexander's* crew are mighty proud of him.

When the Philippines were evacuated, *Alexander* was the last known survivor of his squadron and General Brett chose him for his personal airplane. From that moment the battered veteran began to pile up an astonishing mileage. He flew far enough to take him fifteen times around the world, and he is said to have broken the existing Australia-to-America record.

Not all of these flights were plain sailing. Once he was carrying General Brett and Brigadier General Ralph Royce on a routine flight over the Australian desert when the navigator lost his way. They roamed around for eight hours, in which they encountered every type of weather Australia had to offer—lightning, rain, electrical storms, and a terrific wind. The radio was out of action and everything went wrong. Finally they landed safely and were later located.

Another time, *Alexander* was used as a hospital ship, flying over a thousand miles with a soldier who had been badly wounded by Japanese bomb splinters. Today *Alexander the Swoose* is decorated with three stars to denote that he is the flagship of a lieutenant general.

General Arnold, the Commanding General of the United States Army Air Forces, who has always believed in the big bomber, told the story of another Fort, *Thunderbird*, when he visited the Seattle War Show in October, 1943. Seattle is the home of the Boeing Air-

craft Company which manufactures the Fortress. Attending the meeting was *Thunderbird* in person, battle-scarred and tattered, a tribute to the toughness of American-built planes and the gallantry of American fighting fliers.

"*Thunderbird,*" said the General, "is a veteran of the Tunisian campaign. She brought her crew back to an air base near Tunis on two engines.

"*Thunderbird* was three days late, for she had had to stop at Pantelleria to get patched up. She was the first Fortress to land on that bomb-cratered island, but her pilot put her down on the field as if she were a crate of eggs.

"That was the second time *Thunderbird* had performed such a feat—twice shot to pieces by 'flak,' by hostile fighters, in almost unflyable condition, she had come home.

"On this day at Messina, *Thunderbird,* after being hit repeatedly by shell fragments, dove from 23,000 feet down to water level with the two port engines blazing and a swarm of fighters on her tail.

"Other B-17 crews on the mission saw her go down and reported she could 'never pull out of a dive like that.' Our young American airmen are good—they seldom lose their heads when under the most critical conditions. This pilot was no exception—he talked calmly to his crew. 'Don't waste your ammo . . . take it easy . . . let them come in close. . . . We're going to be all right.'

"The crew obeyed instructions and calmly manned their guns; and one after another the Nazi fighters closed in—and were shot down, until nine crashed into the sea.

"There were over fifty bullet holes in the Fort; the gas was so low that to reach North Africa was out of the question, so Pantelleria had to be their goal. It was Friday when they made it, and on Sunday, after emergency repairs, they flew back to Tunis. As an anticlimax each member of the crew brought with him a big Pantelleria cheese, as they said, to prove their story—that a landing had been made on Pantelleria.

"There was a lot of handshaking at the base, with many saying, 'Boy, I sure thought you were dead'—too much so, for all their clothes had been packed, ready to send to their next of kin."

No wonder General Arnold, himself a veteran flier, is proud of his young men and the machines they fly.

Scarcely a day passes without a Fortress getting its name in the newspapers through a staggering feat of endurance. One bomber named *Jenny* was renamed *Flaming Jenny* after flying back from

a raid on northern France aflame from nose to tail. Two engines had been put out of action. *Jenny* had fought off sixty Nazi fighters and had been wounded in two thousand different places. Her scars healed and her blisters painted over, she continued on operational work.

Few of the B-17's operating over Europe are without scars. Some have piled up an astonishing total of war flying hours. *The Memphis Belle* recently flew to America under her own power after having taken part in twenty-five raids over the continent of Europe, during which she flew over twenty thousand miles.

General Arnold greeted the battle-scarred lady. "The grandest thing of all," he said, "is that the same crew is bringing her back today that flew her away eight months ago." On the sides of *The Memphis Belle* are painted eight swastikas to denote the number of German planes she has definitely accounted for. Her crew of ten have twenty-one decorations—the odd one is the Purple Heart awarded to Sergeant Quinlan, only member of the crew to be wounded throughout the operations. *The Memphis Belle* herself has had over a hundred wounds.

In the Middle East and North Africa, B-17's were heavily engaged. They sank Italian battleships at Maddalena, and at Bizerte destroyed airfields galore. On one flight a squadron of Forts accounted for fifty-two enemy planes in the air and on the ground. An R.A.F. spokesman said: "We didn't believe in daylight bombing. We do now. The Americans knew what they were talking about. It has worked out well. With our night bombers, we now have an undreamed-of round-the-clock hitting power. We can do with all the big bombers you send us." All of which adds up to the fact that the Fortress is a first-class bomber of which Americans can be proud.

Chapter Four

THE LIBERATOR

ON the ground, with its thick belly and queer stance on the three-wheeled undercarriage, the B-24 looks rather like an oversized ugly duckling. In the air it is as graceful as the best of them, a lovely, soaring seventeen-ton beauty, with a performance that measures up to the finest warplanes in the sky today. The Consolidated B-24, or Liberator, of the United States Army Air Forces and Navy, the youngest of our land-based bombers and to date the largest weight-carrier of all United States bombers of which details are available, with a brilliant war record, is typical of American warplanes.

The Liberator is a worthy stable-mate to the Fortress. The basic difference between them is that, while the Fortress today is a job of evolution, made under actual flying conditions, the Liberator is the result of an entirely new concept, particularly in aerodynamics as applied to big bombers. There is no doubt that it is one of the most beautiful ships to look at—lean and graceful, without bumps and bulges. With its tricycle landing gear, ultra-narrow fuselage, and the unique Davis airfoil wing design, it is symbolic of the airliner of the future.

Its pedigree is a long one, going back to 1927, one of the most important years in American aviation. 1927, you will remember, was when a young man named Lindbergh made a solo flight to Paris, and when other airmen began to think of the airplane as a vehicle for long-distance flights. This same year Mr. I. M. Laddon, a designer who was little known outside aeronautical circles, joined the firm of Consolidated Aircraft with the idea of designing long-range planes, for which the United States Navy was asking.

Mr. Laddon was a practical visionary. He began thinking of long-distance flying boats. He consulted with his fellow designers and engineers and began an astonishing record—a record which has never produced a completely bad airplane or a freakish ship. It would be difficult to analyze Mr. Laddon's success, except to say that most of the planes he designed were good basic ideas and capable of modification as well as development. A good airplane begins as a good basic design. To the basic design, as manufacture proceeds and ex-

perience produces results, the designers add their modifications. To scrap a design completely and start anew would be a tragedy. Some designers have had to do it, but only when the basic design was found faulty.

The story of these early flying boats which contributed to the development of the Liberator was first told in *Plane Talk*, the magazine issued by the Consolidated Company, who kindly provided the writer with the material.

The first flying boat Laddon and his fellow designers produced was the Admiral. The Admiral had a wing span of a hundred feet and was at the time the largest flying boat ever built, not including the freak Dornier DoX built by Germany's Dornier Company for the trans-Atlantic service. The Admiral was a practical job, and behaved well on its test flights. Certain improvements, however, suggested themselves and the Admiral was modified. The resulting ship was named the Commodore. Fourteen of these were built. Each had a passenger capacity of twenty to thirty people. They were put into service on the airline to South America operating over nine thousand miles through fifteen countries.

The Commodores would seem slow and unwieldy beside the modern Liberator but some of these ships are still flying. Laddon next designed a flying boat (PBY) which won a Navy competition for performance and resulted in an order for twenty-four planes. These planes had a wing span of one hundred feet and were sixty-two feet long. With them, in 1934 the Navy made a record nonstop flight from San Francisco to Honolulu.

Consolidated then decided to move from Buffalo to San Diego, because they wanted a harbor free from ice all year round for continuing their research and experiments on flying boats.

In San Diego, in June, 1935, the Navy gave Consolidated what was then considered a huge order. They wanted sixty PBY's, and thus was born one of the most famous of the Consolidated family, the Catalina (PBY-5). The "Cat" was far in advance of its time, and many of the original sixty planes are still in service. Their extraordinary prowess in peace and war resulted in the Navy's placing an order for $30,000,000 worth of them in the spring of 1943.

The Catalinas immediately became well known for records in speed and endurance. Eighty-eight of them flew nonstop from San Diego to Hawaii. Sir Hubert Wilkins covered nineteen thousand miles in one, looking for the lost Russian polar fliers, and Richard Archibald and Russell Rogers flew around the world in their PBY.

How modification works on good design is demonstrated by the fact that the Catalina is the direct ancester of the PB2Y-3 (the Coronado), a giant four-engined bomber and transport, which with its thirty-three tons loaded is one of the Navy's largest aircraft. In production, it weighed five tons more than the fully loaded Liberator.

After the Coronado came the PB4Y which is really the Navy's version of the Liberator. Little was heard of this model, the Army version which it sired getting the limelight. However, on June 8, 1943, Winston Churchill revealed to the British House of Commons that a very-long-range plane known as the VLR used with such effectiveness against submarines was the Liberator bomber. These planes, it was later revealed, were used by the Navy to undertake the Bay of Biscay patrol to operate against enemy shipping and submarines, and were prominent on the North Atlantic patrol as submarine destroyers. Their excessive range made it possible for them to continue on their flight across the Atlantic if the weather became unfavorable at their own bases, and land for refueling, making a shuttle patrol the next day. Navy pilots who formerly undertook long patrols in Catalinas are now flying these PB4Y's. It was a Liberator patrol that enabled the British Navy to sink two German destroyers off the west coast of France early in 1944.

The Army saw that Consolidated's reputation in building long-range flying boats was firmly established, and at the outbreak of war in Europe, they asked Consolidated if their designers could do anything in the way of providing the Army with a four-engined bomber. By this time, the Army was fully sold on the idea of four-engined bombers, fortunately, but it had only the Fortress, which as we have seen was a comparatively old aircraft. The Fortress at that time had not undergone its process of rejuvenation, so the Army was looking for something new.

Laddon and Tom Girdler went to work. They started from scratch with a great deal in their favor. Experience in aerodynamics and design had made much progress since 1927, and they found they could give this bomber greater speed, more range, and a heavier loading capacity than any other plane in the air, even while fulfilling necessary Army specifications for armor and armament.

The Army had very definite ideas on the problem facing it. General Arnold and his aides knew that global war was not very far off. They had the latest data from both Britain and Germany with which to work, plus their own ideas of what a long-range bomber should accomplish. The Consolidated designers went to work in

January of 1939 and produced the Liberator bomber in record time for such a large ship. They had not built a big landplane before, but they decided they could build the bomber that was needed—and build it quickly. On January 20, 1939, Major Reuben Fleet and I. M. Laddon instructed the engineers to start on the mock-up of the new plane. Then they left for Dayton, Ohio, to discuss the all-important contract with the Army.

On January twenty-third, the engineering department finished their rough preview drawings and inboard profile and began constructing the mock-up. Two weeks later it was finished. It consisted of a wooden fuselage and one-half of the wing, with two engine nacelles. The fuselage was complete, with plywood bulkheads, plywood skin, undercarriage and tail surfaces. There was even an instrument panel with pictures of instruments pasted on it.

On March twenty-first, still working against time, the engineering department finished its preliminary detail specifications for the new bomber, and they were mailed to Dayton for examination by the Army. Still dubious, but with growing interest, the Army decided to send a mock-up board to San Diego. Members of the board arrived, approved of what they saw, and on March thirtieth a contract for the first B-24's was signed. March thirtieth is the date from which the Consolidated engineers count their nine months' construction time for the Liberator. The plane did not go on the drafting boards until then because the Army insisted on complete revision of the mock-up and equipment, which meant that most of their early work had to be thrown out.

This revision took twelve more days, and the Army's board then returned to Dayton, satisfied. From then on the real work of building the Liberator went forward with a rush. Once they had made up their minds, the Army wanted the plane in a hurry.

Wind-tunnel tests and changes in design indicated by these tests took up most of April and June. The last of the changes was made on the tail assembly June twenty-second. As work on the B-24 progressed steadily, the mock-up was always one jump ahead. One by one, controls, cables, and plumbing went into the huge machine, were tested, and were finally installed in the plane itself.

The job proceeded so fast that various parts were often lofted without making the drawings until long after they were installed. Mr. Laddon appointed Frank W. Fink, Consolidated's chief production engineer, as project engineer for the B-24. He estimates that

about 125,000 engineering man hours went into the work on the new model. More than four thousand sheets of drawings were made, illustrating twenty thousand parts—twenty thousand square feet of drawings—nearly ten acres of blueprints!

On July twenty-second, engineering completed its work on the wing. Six days later the fuselage was done. On August tenth, the Army sent another large order for B-24's, incorporating certain minor changes—all this before the first model had made its test flight.

On September twelfth, 98 per cent of the drawings and engineering was completed. Engineers who had been putting in from fifty to fifty-five hours every week at last had a chance to breathe. The great machine was ahead of its engines. The designers got on the telephone and arrangements were made for the engines to be flown to San Diego. The first two arrived October thirteenth, the second pair five days later, and on October twenty-eighth, wings and fuselage of the big bomber were joined together.

The engines were run for the first time on December twenty-sixth. Trouble developed with the fuel pumps and the fitters worked feverishly to correct the difficulty.

On December twenty-ninth came the big day. Nine months, less one day, from the time the giant plane was given the go-ahead by the Army, the finished product roared down the runway at Lindbergh Field and took off for its test flight.

The Army had ordered forty-six, and, almost immediately, it wanted more. Once the Liberator was in the air, the problem was how its production could be multiplied, not in months but in weeks. A few hours' journey from San Diego, in a suburb of Los Angeles, was the Vultee Aircraft Corporation, which had been taken over by the Consolidated Company and was producing the basic trainers that were required in great numbers at this time to supply the urgent need for pilots.

Using an entirely new production principle, the Vultee Corporation had been able to deliver trainers in hundreds instead of dozens. It was decided that the same methods could be applied to the production of the huge Liberator bombers.

The job was a stiff one. It meant the reorganization of the supply of raw material, rearrangement of man hours, special training of production experts, and application of speed-up methods to the last detail. The plan worked, however, and soon Liberator bombers went into mechanized production.

The assembly line at the San Diego plant is an astonishing demonstration of mass production. It consists of an oval track on which partly finished planes travel the whole length of the assembly plant and back, out onto the airfield where the machines take off on their test flights. The main sections of Liberators are fabricated in advance, as sub-assemblies, and brought to the assembly line for mounting. The fuselage is made up of two parts, the tail and nose. First step on the assembly line is to join these two parts with the center wing section, already mounted on the track by a crane.

A jig, or scaffolding, is fitted over this to hold the parts in position while they are being riveted. Still in the jig, the assembled parts move on slowly to the next station, where bomb-bay side panels, bomb racks, catwalk, and bulkhead segments are added.

This unit passes on, round the curve, gathering tail planes, and other parts. On the second half, engines, stabilizers, and rudders are fitted. Another short move, and the outer wing sections are joined, giving the new-born monster a wing spread of well over a hundred feet. After this the bomber is tilted to an angle of forty-five degrees to save space and continues its trip in this diagonal position.

You begin to see the problem facing the planners of the assembly line when you realize that each Liberator contains approximately 102,000 parts, not including the 85,000 nuts and bolts, and 400,000 rivets. Before it reaches the end of the assembly line, it must be ready for its test flight. That means that every wire, tube, hydraulic conduit, and instrument line has to be correctly joined to its mate. Tanks must be ready to take in gas and oil; and every detail must be in place according to the blueprint.

Sub-assembly of the nose section is as complicated a job as you could wish to find. It contains some 700,000 parts, including 3000 feet of wiring, 2000 electrical and plumbing connections, and 2000 feet of tubing. It contains all the thousand and one gadgets needed by the pilot, the navigator, and the radio operator, as well as the controls and lighting needed by the bombardier.

The first part of the nose section to be assembled, on a mezzanine above the main assembly line, is the flight deck, where sit the pilot and co-pilot, at the terminal point of the bomber's controls. The flight deck divides the nose in half if you look at the machine in sections. When it is assembled with all its parts, it is sent to a portion of the sub-assembly plant where the bulkheads and belt frames are riveted into place. From another section is brought the Plexiglas forward section, the assembled radio cabin, and the nose wheel as-

sembly. These are joined together and swung by crane to the assembly line. Then a strange thing happens. The nose is cut into five sections —top, two sides, bottom, and flooring—to permit the installation of thousands of pulleys, wires, buttons, valves, and conduits. The five parts move along the assembly line, gathering pieces of equipment, and are finally merged, complete to the last piece of soundproofing—the "brains" room of the great bomber. It sounds like magic, but it works.

The Consolidated-Vultee people can well be pleased with the results of their assembly. In the first nine months of operation, they were able to produce 2.3 planes for every one produced at the early stage of production, and a year later they effected a 60 per cent decrease in the man hours required to produce the bomber. All the time, however, modifications were being made. Planes that began on the assembly lines and that were designed to be like six others farther along the line would emerge into daylight of the testing field slightly more up to date. How quickly the Army modifies planes according to combat requirements is shown by the fact that during 1942 more than two hundred construction changes were effected without interruption of the steady flow of planes.

Output at San Diego increased, and a second plant was put into production at Fort Worth. Later, factories at Dallas and Willow Run undertook to manufacture Liberators from Consolidated's blueprints.

The Liberator is primarily designed for high-altitude day bombing at excessively long-range, and for precision work using the Norden and Sperry bombsights. It is a good example of precision thinking.

Liberators are not only employed as bombers. They soon demonstrated themselves to be the fastest and most economical means of air transport both for personnel and supplies. One of the best-known Liberators in the air today is the one which has flown England's Prime Minister, Mr. Winston Churchill, on many of his journeys. This ship is called the *Commando* and is piloted by Captain Bill Vanderkloot and Captain Jack Ruggles, both of whom joined the R.A.F. Ferry Command before the United States entered the war.

The *Commando* is especially equipped as an airliner. In its bunks, located in a compartment above the bomb bay, many famous people have slept, including General Smuts of South Africa, Lord and Lady Halifax, Premier Sikorsky of Poland, and Wellington Koo of China. It recently brought Anthony Eden to Washington for a visit. In fact, the *Commando* has probably covered more of the routes that

will be the airlines of the future than any other machine. Vanderkloot and Ruggles, who were recently decorated by the British government, estimate that they have flown over 200,000 miles in their plane without any serious trouble.

Mr. Wendell Willkie made his *One World* journey in a Liberator, and General Arnold recently flew from Australia to the United States in a Liberator, in the record time of thirty-five hours. One Liberator took the Averill Harriman mission to Moscow and then continued on around the world, piling up an astonishing mileage of 24,700 miles. Another, piloted by Captain G. R. Buxton of the British Overseas Airways, now operating with the R.A.F. Transport Command, flew from England to Canada in six hours and twelve minutes in the spring of 1943.

The United States Army decided that a certain percentage of the output of Liberators should be used for transports, and the modified plane went into service with the Air Transport Command to fly regularly over the extensive range of its territory. The conversion was simple. The top turret was removed and a hatch put in its place. All armor and armament were taken out. A big door was fitted in the side, and even the bombardier's Plexiglas nose was converted into cargo space. As the C-87, or Liberator "Express," the B-24 became the heaviest weight carrier in service. Its load is said to be in excess of ten tons, with which weight it can travel four thousand miles at over 30,000 feet, carrying a crew of four men, two pilots, a navigator, and flight engineer.

Consolidated designers and engineers are not satisfied by any means that the Liberator in its present form cannot be improved. They state with considerable confidence that there is no foreseeable limit to the size of land-based aircraft. Says Laddon: "Every plane is a definite answer to a question: What do we want it to do? Once we know that, we can design the plane to meet the problem."

Laddon is now working on a mock-up of a full-size wooden model for a transport plane which will be the biggest ever. It is designed to carry four hundred passengers. When they showed this colossus to Major General Doolittle, he looked at it and said, "I don't believe it. It is just a lie." Consolidated engineers know better.

To build the new plane will be a tremendous task, the greatest ever undertaken by the aircraft industry. Blueprints alone for building one model would cover sixteen acres of ground if laid out flat. The footprint of one tire covers ten square feet. Oil for one filling of the tanks is as much as five average families would use in a lifetime. The

heating facilities of this plane would warm a forty-room house. Its cargo capacity is such that a squadron of them could evacuate the whole population of Fort Worth to Kansas City in three days.

The Liberator owes its appropriate name to the R.A.F., whose crews like to name their machines instead of using numbers, as was the previous practice in the United States. Unlike us, however, the R.A.F. does not usually name individual planes, which are known by letters, such as "F" for Freddy, and "B" for Beer. American bomber crews name their planes according to whim, after their home towns, their girl friends, or whatever takes their fancy.

The first B-24's arrived in England in the dark days when Germany was threatening invasion, and submarines and long-range bombers were making the sea crossing of the Atlantic extremely perilous. The grateful British welcomed the monster bomber with open arms and coined the name "Liberator." After some slight modifications in armament, the B-24 went into action as a Coastal Command patrol bomber and quickly showed its mettle. Since its debut on the Atlantic patrol, the Liberator has piled up an astonishing record of victories over submarines.

The British fitted 20-mm. cannon in the noses of their Liberators and sent them out after the submarines and the huge German Focke-Wulf Condors, or Kuriers. The first clash between the converted German trans-Atlantic airliner and the Liberator took place a few hundred miles off the coast of Ireland. The crew of the German bomber were taken by surprise at the appearance of the unfamiliar ship. They surmised it was a bomber being ferried over from America and roared in to attack.

The Liberator's pilot immediately turned its nose toward the huge, but slow, assailant and the gunner blazed away. The first burst of fire knocked off the long nose of the Kurier, and from the cockpit fell two of her crew. The German pilot was unhurt and managed to get his machine into a tight turn. The Liberator tail gunner then got in his burst and set one of the German engines on fire.

Then the American bomber climbed above the Kurier and dived to give the nose gunner another shot. That burst was the end of the German aircraft that until the arrival of the Liberator had been the terror of convoys and master of the air above the high seas, except when unlucky enough to run into a freighter fitted with a Hurricane or Spitfire "Catafighter."

One winter's morning in 1941, the rear gunner of a B-24 on

routine patrol spotted a German Heinkel seaplane flying toward the French coast at a very low altitude.

"Tally ho!" called the pilot cheerfully in answer to the gunner's warning. He put his machine into a steep dive and attacked the Heinkel. "He never fired a shot," relates the pilot, "although we raked him with every gun we had. One of our bursts knocked off great chunks from his fuselage, and another set fire to his engines."

The Liberator was regaining height, when the rear gunner cried out, "There's a big ship down there. It's a Hun!" The pilot banked to have a look. There below them was not only a German light cruiser, but also a submarine, surfaced beside her. The Liberator went down again and raked the submarine with its machine guns and cannon. As the pilot pulled out of his dive, the bomb aimer dropped a stick of bombs that burst in the water close beside the submarine. The U-boat dived, but left a thick patch of oil on the surface.

The crew then decided to have a crack at the warship. "We blasted her with everything we had, and we came so low that we could see our shells and bullets chipping fragments from her deck," said the pilot. "It was real fun while it lasted, but we were disturbed by another Heinkel. He was a persistent beggar. He attacked us four times while we were attacking that ship; each time we drove him off, knocking pieces out of him, but he came back again. The last time he flew into us head on. I thought he was going to ram us, but just as he got within a few feet, he pulled up and turned away. I could see our bullets hitting him. He didn't get far. A piece of his wing came away and one of his floats was dangling in the wind, like the broken leg of a doll. With both engines smoking, he suddenly stalled and dived almost to sea level. The last we saw of him, he was crabbing along, smoking like a pair of factory chimneys. He didn't look as if he could last more than a few minutes.

"Then we had a smack at the warship again, but our ammunition gave out, and we had to set a course for home." On that particular patrol, the Liberator crew had been in the air for more than fifteen hours.

One Liberator while on Atlantic patrol attacked two Nazi Kuriers as they were attempting to attack a convoy. The pilot was Captain H. D. Maxwell of Pink Hill, North Carolina. Captain Maxwell and his crew closed with the two enemy planes as they were going into the bomb runs over the Allied ships. Visibility was poor. The first sight of the enemy was merely a dark shape in the mist. Maxwell turned his big plane and gave his engines the gun. He was pumping

the enemy with all available guns when another Kurier appeared and got on his tail. The three big planes then began a rat-race, each trying to get a position of advantage. On the decks of the ships the sailors stood and cheered. The Liberator was the first of the contestants to be disabled. It landed on the sea, with every man of its crew of seven wounded, its ammunition exhausted and the barrels of the guns red-hot. There must have been heavy hearts among the watchers, but suddenly cheers swelled from every throat. The German plane that the Liberator had first attacked crashed into the sea out of control leaving only a plume of smoke to mark its end, and far away on the horizon the other Kurier also settled to its doom. The American plane had vanquished two of its enemies. All the crew were saved by the merchant ships of the convoy.

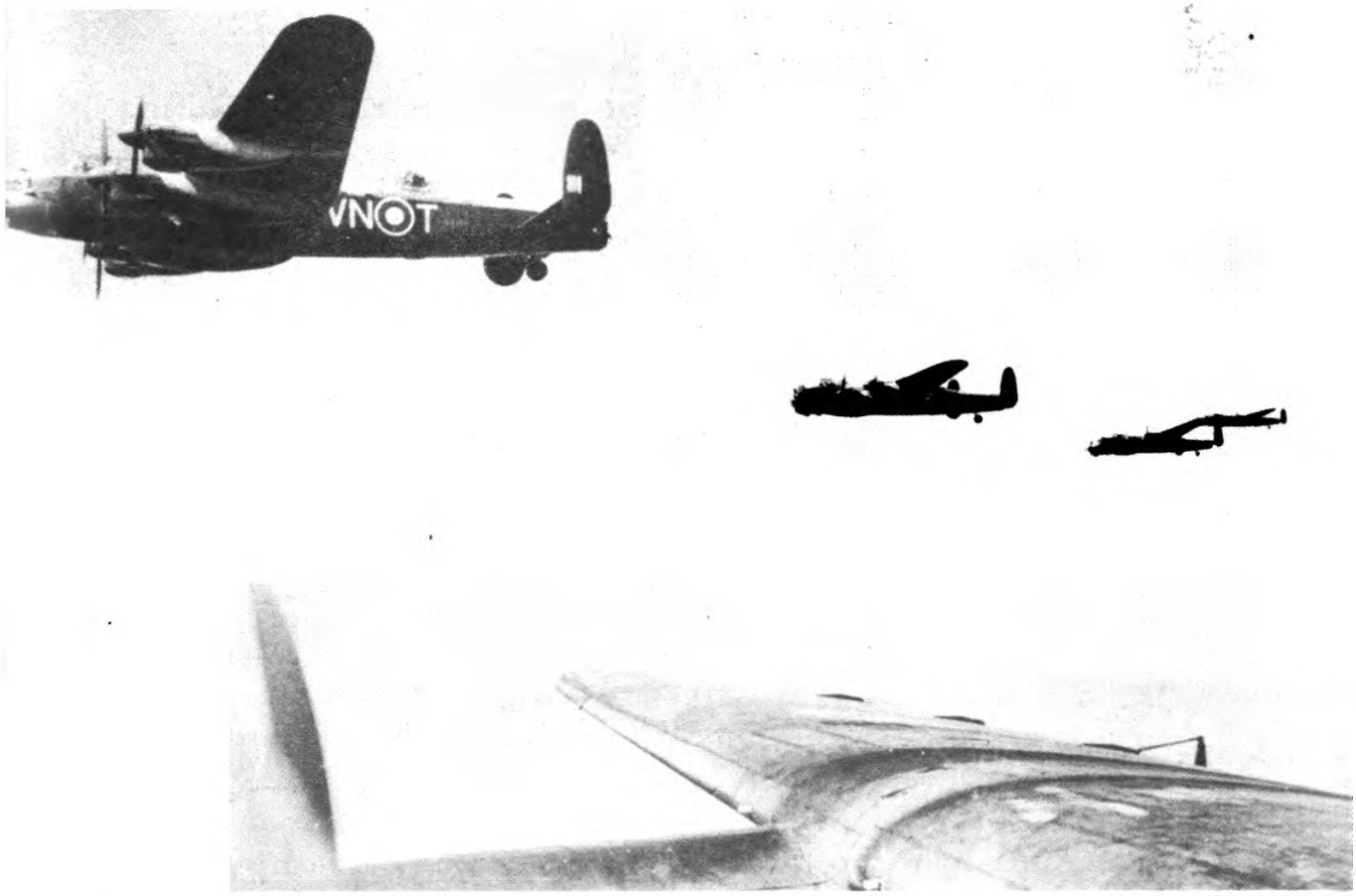
A Navy Liberator pilot, First Lieutenant Frederick McKinnon Jr., of West Roxbury, Massachusetts, caught a Kurier sneaking up on a convoy, and his gunners filled it so full of lead that it limped away at 150 feet altitude with its engines smoking.

The present Liberator, which has gone through a series of modifications until it has reached series E, is generously armed with .50-caliber guns. Its four Pratt and Whitney Twin Wasps are turbo-supercharged for increased altitude. The Liberator is of all-metal construction, with stressed light alloy skin and flush riveting throughout. The most interesting feature is the Davis airfoil, which because of its narrow frontal area is considered to produce 25 per cent less drag, as compared with other bomber wings. If you will look carefully at pictures of the Liberator and the Fortress, you will be able to judge the difference between the two wings.

Many conjectures have been made as to the speed of the Liberator. Latest figures credit it with batting along at something better than 335 miles per hour at 16,000 feet, with a service ceiling of 36,000 feet. Its range with full load at cruising speed is approximately three thousand miles, and it is generally accepted as our greatest long-range weight carrier. The arrangement of .50-caliber guns now on the Liberator makes it just as formidable as the Fortress, and with its high speed and extreme nippiness, this B-24 is quite capable of taking care of itself in daylight raids.

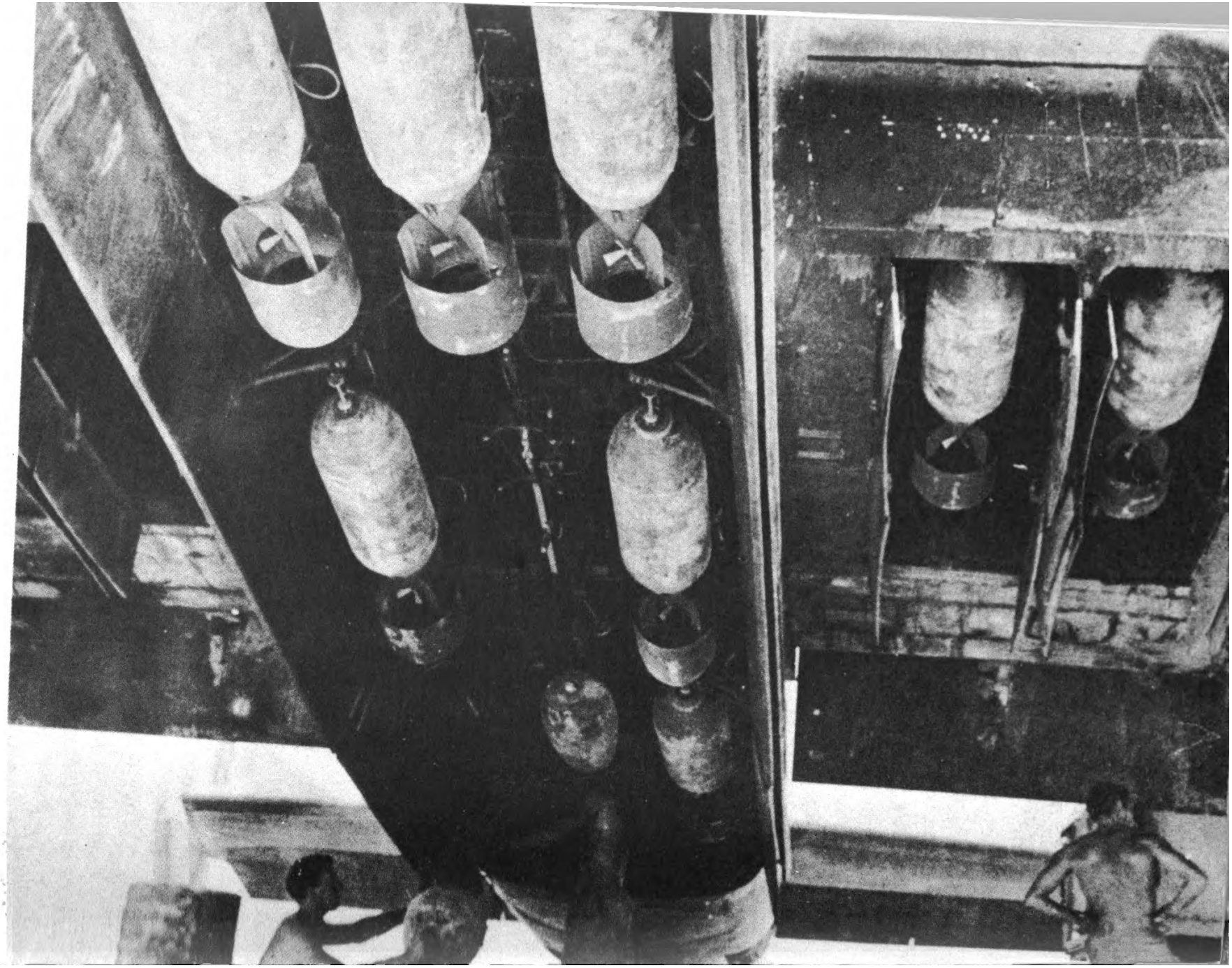
Over New Guinea a squadron of unescorted Liberators was attacked by twenty-five Japanese Zeros. The American gunners acquitted themselves well, scoring a hit on every Jap fighter and knocking down at least six.

Another Liberator, on a mission over France, was engaged by



(Above) R. A. F. Lancasters bound on a daylight mission. *British Official Photograph.*

(Below) Final preparations are made on one Halifax bomber at a Middle East base, while another roars overhead on the way to the target. *British Official Photograph.*



An R. A. A. F. Middle East Halifax receives its bomb load. *British Official Photograph.*

twelve German Messerschmitt 109's and shot down three of them in a twenty-minute fight, driving off the entire squadron without being damaged itself.

The first reported battle test of the Liberators carrying the United States Army Air Forces' insignia over Europe was the huge daylight raid on Lille on October 9, 1942. Escorted by five hundred fighter planes, and in company with Fortresses, the big bombers poured tons of bombs on the great Fives steel works at Lille, which were turning out main-line locomotives for the Nazis. The factories were in full blast, but after the massed bombers had passed over the great sprawling industrial center at 30,000 feet, it was blanketed with the smoke of countless fires.

How many Liberators were lost on that raid was not disclosed, but out of more than a hundred bombers in all, only four did not return. Said Major Kenneth Cool, leader of one Liberator squadron: "I'm ready to go back any time with our Liberators. We gave 'em hell. There must have been forty or fifty German fighters around us at one time. Our gunners were really getting them."

It was said that this particular squadron had downed at least seven of the FW-190's, and the figures were later amended favorably. The net result of the raid proved that the Liberator with its high speed and new armament could undoubtedly hold its own against German fighters. Precision bombing, however, rather than fighting, is the Liberator's specialty. Its crew aim to get to their target faster and drop more bombs nearer than any other plane in the air.

One of the most outstanding Liberator exploits was the bombing of the vital-to-the-Axis oilfields at Ploesti, Rumania. This raid was carefully rehearsed and executed. Some two hundred of the big bombers made the attack from tree-top level. The raid involved a round-trip flight of 2400 miles, and the use of a special low-altitude bombsight. Two thousand United States airmen participated, and enormous damage was done. The value of that raid is best told in the words of General "Hap" Arnold. Discussing it at his press conference he said:

"We have known for a long time that oil was a very critical item so far as Germany was concerned. We made one attack on Ploesti sometime back which wasn't so hot. This time, after a very careful preparation, and months of drilling, we sent many B-24's against the Ploesti refinery areas, which covers some forty miles by about twenty miles. Thirty per cent of the Axis requirements of oil comes from Rumania. There are nine refineries there. We hit six of them.

The total production of the nine refineries is about 9,000,000 tons a year. We destroyed 42 per cent of the Rumanian refinery capacity; 3,900,000 tons was the capacity that we destroyed, for a period of at least six months. Three of the refineries will never be able to operate until after the war, when they can get additional equipment.

"Incidentally, we lost some airplanes—but that is merely incidental. The damage is there. They don't get that oil production, and they can't get it until the war is over—which will be too late."

Liberators have been in action in practically every theater of war. These were the bombers that made the 2000-mile round trip from Pacific bases to drop 24,000 pounds of bombs on Japanese-held Wake. From Australia, Liberators carried 2000-pound block busters to Rabaul, and during the Aleutians campaign, Liberator pilots carried out more than twenty raids on the island of Kiska.

The Liberator gunners have been particularly successful against the Japanese Zero fighters in the Pacific. On one mission a group of Liberators shot down thirteen Zeros and damaged six more without loss or damage to any of their number.

One Liberator which was shadowing eight Japanese destroyers was attacked by fourteen Zeros. The pilot climbed from 6000 to 9000 feet and prepared to stand off the attackers. The Japs must have thought they had an easy thing for they closed in from all angles. Within a few seconds some of the Japanese pilots changed their minds and broke away before getting in close enough to open fire. Those who did come in suffered severely. The Navy report said: "The Zeros made individual runs on either quarter, but few closed to effective range. One closed in and had his tail blown apart from about 500 feet. Others appeared astern and at least four were hit. One pulled up to a stall and quickly exploded and disintegrated under the combined fire of bow and tail turrets. Another Zero was hit by the top turret, tail turret and belly guns and burst into flames. The others broke combat and the Liberator completed its mission and returned safely to base."

In the Pacific the Liberators have been tangling with a twin-engined Jap plane which the Navy pilots call "Betty," as well as with the Zeros. Betty, a torpedo plane, has been getting distinctly the worst of the encounters, so much so that Liberator pilots are sorely tempted to use their craft as interceptors whenever Betty makes an appearance. One Liberator squadron chalked up a record of shooting down four Betty's in four consecutive days. One Betty put up a

terrific battle, and the Jap rear gunner succeeded in shooting out one of the Liberator's engines. The Liberator gunners, however, retaliated with good effect, and the torpedo bomber dived into the sea in flames after the pilot tried unsuccessfully to ram the American ship. Another Liberator chased a Betty for four hours in a cloud bank. The end of the battle came when both emerged from the cloud a mere 800 feet above the sea. The Liberator's .50-caliber guns did a good job on this particular Betty and then it exploded.

In midsummer of 1942, when the British were faced with the formidable task of driving Rommel from his positions perilously near the Suez Canal, the "throat of India," Major General Lewis Brereton sent several squadrons of B-24's to assist in the task of blasting Rommel's supply lines. The British were delighted. "Send us more of these big beauties," said an R.A.F. spokesman. "We can do with them!" Liberators immediately began a "milk run" to Bengasi. They piled bomb after bomb on the hapless port, alternating day and night with the British Lancasters. On one raid, ten Liberators sank or damaged every ship in the harbor and also managed to disperse repeated attacks by Italian Macchi fighter planes.

During the North African campaign, Liberators flown by U.S.A.A.F. and R.A.F. pilots put in more than twenty-one thousand flying hours, dropping more than 8,500,000 pounds of bombs in over five thousand sorties. They were credited definitely with sinking forty-nine ships, with twenty-five more probably sunk, and twenty-eight severely damaged.

For duty in the South Pacific and in China, the Liberator is likely to be used more than any other heavy bomber. General Chennault's Fourteenth Air Force is already equipped with a number of Liberators, and on one of their first raids on the Japanese-held harbor of Canton, they dropped 80,000 pounds of explosive and incendiary bombs on harbor installations. In the Pacific, Liberator pilots participated in an attack on a huge Japanese convoy making its way toward Australia. It was during this attack that ten warships were disabled, twelve transports wiped out, and fifteen thousand enemy troops drowned.

In the Aleutians, the giant Liberators did a giant's job in handing out a beating to the Japs who were trying to consolidate their toehold on Uncle Sam's finger of territory which points so menacingly at the heart of Japan. The weather at Kiska is never a picnic. It alternates between soupy fogs and raging rain and snow storms, with

the winds at gale speed. The only way to manage precision bombing under such circumstances is to fly low under the clouds and drop the eggs right on the nest.

The job was handed to a section of Liberators whose crews had just been transferred from Fortresses. The bombers roared through the thick clouds in formation and came in over Kiska Harbor at about fifty feet above the water. The bombardiers opened their bomb bays simultaneously, laying a terrible pattern on the ships and dock installations as they passed.

Said one of the bombardiers, describing the action: "I could see the explosions beneath us and feel the heat of the fire bombs pouring in through the open bomb doors. A sea of smoking flame began to spread and flow all over the target. The bombs seemed to have dropped everywhere. Every ship in the formation had unloaded at once. It was an incredible sight. Then the delayed-action explosions began behind us. That was some noise."

This was probably the lowest altitude from which Liberators had operated, but they came through with flying colors and no losses. *Kiska Sal,* one of the Liberators concerned, repeated the operation several times and now has a healthy record of Japanese ships sunk and Zero fighters pulverized.

Two Liberators in the Mediterranean gave a good account of themselves at high altitude. They were *Alice the Goon* and *The Witch.* Over Greece a squadron of Me-109's and Macchi 202's swooped down to attack their group of Liberators. One Messerschmitt got close in to *The Witch* and literally filled her full of lead. A shell hit a gas turret. *The Witch*'s guns began blazing, while her gasoline caught fire and bullets continued pouring at her, severing the gun mountings and smashing a bulkhead support. *The Witch* flew on, as if nothing were happening.

The pilot called back to the rear, "Anybody hurt?"

"Yep," answered the rear gunner. "All of us, but we got him."

The German fighter plane was rolling over and over with flames belching from its greenhouse. Another Messerschmitt attacked. *Alice the Goon* gave it a burst, and down it went. Next a Macchi appeared, and slid down until it was almost on *The Witch*'s back. It was the most foolish thing the pilot could have done. As if timed by a stop-watch, the turret gunners of all nine Liberators opened fire on the hapless wood and metal fighter. Every gun was giving it something. The Macchi disintegrated suddenly as if pulled to pieces by giant invisible hands tugging at the wings, tail, and nose. The

pilot bailed out, miraculously still alive. The remaining fighters made for home.

If bombers carried battleflags, the B-24 Liberators would have twelve campaigns on theirs, for since the outbreak of war these big "babies" of bombardment have dropped their calling cards on such places as Wake Island, Kiska, Burma, the Solomons, North Africa, Germany, France, South Pacific, Italy, Sicily, the Middle East, and China. Quite a record for our newest heavyweight.

The Consolidated Vultee Aircraft Corporation announced at the end of 1943 that three versions of the Liberator would be built in 1944, the B-24E, the PB4Y, and the C-87, stating that these three versions would be in operation in greater numbers than any other four-engined aircraft.

Chapter Five

BRITISH HEAVIES

Lancaster and Halifax

THE British developed bombing into a fine art during World War I, and although successive postwar governments were extremely careless and disregardful of the march of events in Germany, there were fortunately realistically minded men inside the Air Ministry who were looking into the future. These nameless heroes who survived the stupid and brutal slashing of the R.A.F. immediately after World War I to 10 per cent of its wartime strength knew that if ever another war burst over Europe, the bomber would be the key to victory. They knew too that they would most likely have to bomb Germany.

In spite of niggardly allotments by short-sighted politicians, and in the face of fierce opposition, these professional soldiers always managed to keep bomber development moving forward. Airplanes in those days were handmade and exceedingly expensive. It must have taken a lot of time and hard work to explain to politicians

just why you should spend a million dollars on bombers. Somehow these men got what they wanted, and British bombardment designs were fairly progressive, although no one gave serious thought to the development of the four-engined model that had appeared at the close of the last war. Men thought a twin-engined bomber could carry sufficient weight of bombs anywhere England might want to strike, and so most of England's bombers were in the medium class.

Some of these medium bombers had very creditable performances in range, particularly the Vickers Wellesley. Two Wellesleys flew from Egypt to Darwin, Australia, a distance of 7162 miles, without stopping off. This aircraft is an important link in the chain of British bomber development. It demonstrated the reliability of British engines, and also the sturdiness of the geodetic basket-weave method of construction. Data provided by its record-breaking flight was of immense importance in the construction of future bombers.

In the fall of 1935, the men behind the scenes at the Air Ministry began giving serious thought to the task ahead. They decided first to build fighters to enable Britain to fight a defensive war, and they decided that when the time came for bombing German industry they would do a thorough job, dropping a heavier weight of bombs per plane than had ever been dreamed of.

In the conference room of the great Air Ministry building was held a meeting that may well be said to have helped in deciding the history of Europe. It is difficult from this point in air history to overestimate its importance. Suppose, after that meeting in January of 1936, the Air Ministry had not called for specifications for four-engined bombers? Suppose it had been their decision to equip the R.A.F. Bomber Command with twin-engined heavies, supported by medium bombers? What if Britain had decided to follow the example of the Germans, to concentrate on the fast medium-weight bomber? Two countries were preparing to bomb each other, and what was sauce for the goose would be good enough for the gander? As far as those men at the conference table knew, the airfields to be used by R.A.F. bombers would be on the French side of the Rhine, with Berlin an easy distance for a machine carrying a two- or three-ton bomb load.

Someone may have remembered the lessons of the last war, the grief and pain at starting too late, and the four-engined Handley-Page giants that went into action only after the Armistice, in India. Another may have contributed the suggestion that a 500-pound bomb could do a lot of damage, but that a 2000-pounder would be

even more conclusive. The minutes of that conference may never be made public, but we know that with heaven-sent inspiration and belief in the axiom, "If you intend to do a thing, do it well," which every British school boy writes in his earliest copybook, the R.A.F laid plans for the super-bombardment of Europe by asking the British aircraft industry to construct four-engined bombers, armed and armored, each to carry some eight tons of bombs over a 2000-mile range.

Three firms took up the specifications, which became known as B36, signifying a bomber built in the year 1936. They were the Handley-Page Company, the Short Brothers, and the Avro Company of Manchester, all seasoned manufacturers of military aircraft. The Germans continued blissfully building their medium bombers, dive bombers, and fighter-bombers, writing the pattern for defeat in the swift standardization of their production.

The result of this clear thinking has paid heavy dividends in action. The Germans failed to do crippling damage to the comparatively tightly packed island of England, using mainly 250- and 500-pound bombs, with an occasional 1000-pounder aimed at a special objective. British four-engined machines are nightly hauling 8000-pound block busters to German industrial centers. The explosion of one 8000-pound bomb can damage a built-up area of some twenty thousand square yards. The effect of a hundred of them falling simultaneously can be imagined. I remember the building in which I was working in London being struck by a 500-pound German demolition bomb. The result was messy, but not fatal. If it had been an 8000-pound bomb, I cannot by the wildest feat of imagination see myself or anyone who was with me surviving as we did, with nothing more than shock.

The British went about building their bombers on a steady plan. In principle, they followed the maxim laid down by the great military strategists of the past, Alexander the Great, Genghis Khan, and Napoleon: Disperse to journey; concentrate to strike. They dispersed to manufacture and concentrated to build. Parts of the huge aircraft were made by small factories and by individuals. These parts were then assembled into units and dispatched to the assembling plants, to be welded into the complete airplane.

In order to neutralize the effect of enemy bombing, every item of construction was duplicated or multiplied many times. If it happened that one factory was destroyed, or a part of it put out of service, three or four other factories would immediately be able to

produce the same parts, using identical jigs or assembly tools. Thus at no time were the assembly plants starved of material.

The giant British Lancaster is said to be the bomber the Germans fear most. This huge aircraft has handed out more punishment by weight of bombs than any other British aircraft. As bombers go, the Lancaster is middle-aged. As pedigrees go, it has probably the longest of any airplane flying today, one that dates back to the very earliest days of aviation.

The name Avro, the parent company of this huge four-motored bomber, was known in aviation almost before airplanes flew. A. V. Roe, now Sir Alliott Verdon Roe, founder of the Avro Company, is popularly credited with being the first Englishman to get off the ground in a machine of his own construction. He achieved this at Brooklands motor-racing track in England in 1908, just two days after the American S. F. Cody had made his flight at Aldershot, then the home of British military aviation.

There has always been an argument as to whether A. V. Roe was the first Englishman to fly, but no one can deny that he has played a considerable role in the development of England's aviation. He began as a marine engineer, a status he earned by going to sea before the mast, and serving as a greaser and stoker. His hobby, however, was building model airplanes, and when one of his models won a prize, he decided to build a full-sized airplane.

His first machine in which he made the much-discussed flight crashed. But Roe was not discouraged. With the help of his brother, a regular soldier, he began an aviation company in 1910, and started building a series of biplanes into which he fitted converted motorboat engines.

By 1914, the Avro Company had progressed considerably, and its 504 biplane became the standard trainer of the British Army and Navy. So efficient was this little trainer that its use persisted right through World War I and became a familiar feature of the air forces of most countries, including France, Italy, and Japan.

The 504 was distinguished by a skid, rather like a ski, that protruded from the front between the wheels of the undercarriage. Popularly known as the "toothpick," this was intended to save the machine from landing on its nose and breaking its propeller, in case the pupil misjudged his landing.

After the outstanding success of the 504, Avro went on to build commercial and military aircraft, and when the R.A.F. called for specifications B36, Charles Dobson and Roy Chadwick began work

on the Lancaster, a direct descendant of the two outstanding Avro machines, Anson and Manchester.

The Anson, now used as a bomber-trainer, is powered by two 350-hp. air-cooled Cheetah engines and carries a crew of three, pilot, navigator-bombardier, and radio operator–rear gunner. The Anson has been in service in this war as a Navy reconnaissance plane, but owing to its comparatively slow speed, it was withdrawn from combat work.

The Manchester, which has a very close resemblance to the Lancaster, ranks to date as the biggest of the twin-engined bombers. It was originally designed to be powered by two of the new X-shaped Rolls-Royce Peregrines. These engines developed certain defects, so the design was abandoned, and the R.A.F. decided to concentrate on the four-engined Lancaster. The Manchester was a fast ship, with considerable range and capable of carrying almost as much weight as the Lancaster, but the urgency of war production allowed no time for delay while engine defects were being traced.

The Lancaster, powered by four Rolls-Royce Merlins, is fast and maneuverable. According to pilots, it is as easy to fly as it is good to look at, with its conventional wing design, good streamlining, and generally pleasing appearance. When you see the Lancaster from a distance, you hardly realize its immense size, because of its beautiful proportions. Not until you stand beside it on the ground do you realize its height is just over nineteen and a half feet. The Lancaster's wing span is 102 feet, and its length is 69 feet and 4 inches. Its total weight empty is 35,000 pounds, and its maximum loaded weight is 60,000. The Rolls-Royce Merlin engines tug it along at a speed just over 300 miles per hour, fully loaded. The bomb load is so arranged that it can be alternated with gasoline, additional tanks being easily fitted into the plane.

The story of the building of the Lancaster is a romance in itself. It is the romance of engineers facing the most difficult problem in the world—maintaining production under the rain of enemy bombs. Production of the Lancaster, which began early in 1940, has never stopped, even in the fiercest of the German air attacks during the Battle of Britain and during those harassing nights when the Luftwaffe sprayed bombs at random over the English countryside. Thousands of men and women were putting in valuable hours constructing these aerial mammoths that were later to spread destruction over Germany.

Many people wondered why it was that Germany could not crip-

ple Britain's aircraft production. When you look at your map, and realize how much smaller England is than Germany, it seems that a German air armada flying over England could not fail to hit a vital spot. Had the German raids been organized with the same painstaking precision as those being undertaken by the air forces of the United Nations, history might have a different story to tell.

But the British not only designed their Lancaster as a bomb truck, they designed it in such a way that it could be manufactured in dispersed areas. The machine is first of all divided for production purposes into three main portions: fuselage, wings, and tail. These three portions comprise thirty-six different assemblies. Each of these assemblies is manufactured separately, some in private homes, some in underground factories tunneled into hillsides, and some in normal factories converted from peacetime functions. It is estimated that fifty thousand parts go to make one Lancaster, and that no more than two of these parts are made in the same place.

Big bombers cost money. You can figure about $300,000 as the net cost of a Lancaster, but when a bomber is lost, it is not only a matter of expendable material, but also of trained manpower. The seven or eight men who operate the Lancaster cost about $32,000 in training alone, and so when you read in your newspaper of a thousand of these big planes taking part in a raid, you can calculate that $32,000,000 worth of manpower is flying over the target in $300,000,000 worth of aircraft. Gasoline costs are terrific. These four-motored giants consume an average of fifty gallons of high-octane fuel per hour. On a five-hour trip over Germany, one thousand Lancasters would consume 250,000 gallons, quite a considerable amount.

The Lancaster carries a crew of eight, a pilot and a co-pilot–navigator, bombardier, radio operator–flight engineers, and three gunners. Although not as heavily armed as the Boeing Fortress, since it is normally fitted with .30-caliber guns against the Boeing's .50-caliber, the Lancaster can look after itself. The British are proud of the fact that there are no blind spots on the Lancaster, with its four hydraulically operated gun turrets. From whatever angle an enemy fighter approaches, Lancaster gunners can sight it, an arrangement that has enabled this bomber to pile up an astonishing box score against German fighters, both by day and by night.

Flying in formation, Lancasters are particularly formidable. On one daylight sortie, a dozen, flying in tight formation, reached their targets deep in Occupied Europe, dropped their bombs and got

back to their station in England within a few hours, in spite of fifteen separate attacks by German fighters. Five of the German planes were definitely destroyed, and a large number damaged.

Like all British heavy bombers, the Lancaster was designed primarily for night bombing and for strict utility purposes, that is, to carry a heavy load of bombs. Used by daylight, these bombers rely on a fighter escort and on their speed to protect them from enemy attack. When carrying a comparatively small load of bombs, the Lancaster is capable not only of a surprisingly long range, but also of high speed. One of the most outstanding and daring exploits of a Lancaster squadron was the daylight raid on the German submarine engine works at Augsburg, Bavaria. The British decided that a heavy contribution to the Battle of the Atlantic would be made if the factories at Augsburg were knocked out.

Lancasters roared over the coast of France at little more than fifty feet above the ground. They were divided into two tight formations, so arranged that the air gunners of each craft could support the others by means of cross fire. Similarly, the gunners of the rear formation could drive off fighter attacks made on the front of the other formation. The usual method of fighter attack on bomber formations is to knock off the machines on the outside. Squadron Leader Nettleton arranged his formation to make this difficult. He knew that by keeping close to the ground, the Germans would not be able to get their full operational speed, so he started out with what he considered a strike in favor of the Lancasters.

Flying at top speed at house-top level the two formations of six reached the Paris area before running into trouble. Then it came in the shape of two squadrons of FW-190's and a squadron of Me-109's which attacked the first formation led by Squadron Leader Nettleton, the officer in charge of the sortie. The gunners of the Lancasters put up a terrible barrage of cross fire, flying as they were almost wing tip to wing tip. They were hopelessly outnumbered, however, and the odds were against them.

"There were fighters all around us," recalls Nettleton. "Our fellows were putting up terrific fire. The first casualty was Sergeant Rhodes' aircraft. He was flying to starboard and when his port wing caught fire, he came straight for me, out of control. For a moment I thought we were going to collide, but we missed each other by a few feet, and I saw him crash below. Two others of our formation went down almost at once, and I saw another on fire.

"I didn't have much time to think, myself, because I was too

busy. One bullet chipped out a piece of our cockpit, which hit my second gunner in the neck. I heard him say, 'What the hell?' and we both laughed."

Four of the big planes were separated and never heard of again. The remaining planes of the two formations flew on across the rich fields of France, where they could see the peasants working below, unworried by the flight. Some waved their hands. As they crossed over into Germany, the pilots noticed that the fields were absolutely empty, and there was no traffic on the roads.

Some distance from Augsburg, the winged armada ran into the first antiaircraft fire in Germany. Because they were flying so low, the Germans could not depress their guns low enough to hit them. The Lancasters swarmed in over the target and dropped their bombs with one terrific salvo. One of the planes was hit by small antiaircraft fire from a roof top, but he landed safely two miles out of town. Another Lancaster pilot recalled later that they were flying so low that German fire was actually knocking off the roofs of houses.

The second formation of Lancasters, led by Squadron Leader Sherwood, made the entire journey without seeing a single German plane. Flight Lieutenant Deverill, one of the pilots, related afterwards that as they were crossing the German frontier they saw a man in the uniform of the storm troopers run into a post office, presumably to telephone of their approach. Then they swept low over a field where hundreds of German soldiers were doing exercises. The rear gunners could not resist the temptation to liven up the Nazi's morning activity and had the satisfaction of watching as many as could make it dash to shelter.

Sherwood's formation came over the target just as the last of the first group were dropping their bombs. The light antiaircraft was now terrific. A Lancaster gunner noticed a solitary German sitting on a flat roof working a machine gun. He knocked him off in passing.

Over the target, one Lancaster, piloted by Warrant Officer Mycock, received a direct hit from a large-caliber shell and caught fire. Instead of turning away and making a forced landing, Mycock flew on, released his bombs, and then fell in a mass of flames.

As Deverill was approaching the target, his Lancaster was hit many times and began to burn. The radio operator managed to extinguish the flames, and Deverill made the run over the target. Then the outer port engine stopped, but restarted later, and somehow the

crippled plane was one of the five that managed to return to its base.

Reconnaissance photographs later showed that the Diesel engine works had been shattered by direct hits, and that the production of submarine engines at Augsburg had been seriously affected. Commenting on this, Prime Minister Churchill said: "No life was lost in vain."

For his valor and resource in leading the raid, Squadron Leader Nettleton was awarded the Victoria Cross. All pilots and their aircrews were rightly decorated.

This raid proved very definitely that low-flying bombing was a potent force in aerial warfare, and also that the Lancasters were capable of flying fast enough to outpace Germany's crack interceptors.

When Lancasters gang up for mass raids on production centers, there is sure to be trouble from the ground, no matter how heavily defended the plane may be. It is now well known that it is practically impossible for any type of bomber to get over its target without being detected by the German version of radar, which works in close conjunction with searchlights and antiaircraft fire. To get to its target, drop its bombs, and return to base, a plane must be fast and maneuverable. The Lancaster seems to have all that it takes.

One of the most spectacular raids of the war was that made by a thousand or more bombers over Cologne on the night of May 30, 1942. The majority of these bombers were Lancasters flying in formation without night-fighter protection. One Lancaster tail gunner reported the destruction of three enemy fighters. There were numerous other casualties among German planes attempting to intercept the swarm of bombers, but because the R.A.F. never allows airmen to take credit for enemy planes unless they are seen to fall, these casualties are rarely recorded after night operations.

Since the beginning of the United Nations' all-out air blitz against Germany, Lancasters have taken part in practically all of the big raids. They have bombed Bremen and Emden; they rained four thousand tons of bombs on Düsseldorf in one night, at the rate of three a minute.

On July 11, 1942, one of the largest armadas of Lancasters ever to take off in daylight flew from the British coast to Danzig, some 1800 miles' round trip, and entirely shattered the huge shipbuilding yards there, with what the R.A.F. reported as the "heaviest bomb load ever carried by daylight."

Before the North African coast fell to Allied hands, Lancasters

were employed to carry British block busters to Italian industrial centers. They rapidly became a scourge to the Italians. In October, 1942, a squadron of Lancasters made a daylight raid on Milan. Fighters escorted them over the Channel, and when the fighters were obliged to turn back because of their limited range, the Lancaster squadron leader ordered his machines to form in Indian file. They then dove to within fifty feet of the ground and flew down the Rhone Valley, so low that the rear gunners could see the tops of the trees bending in the wind and the French people waving to them.

They reached the Alpine district toward sunset and climbed gradually until they ran into thick clouds. When they reached Milan, they found their target completely covered by clouds. One by one the bombers dropped through the blanket and deposited their bombs. The wing commander in charge of the squadron said: "All was quiet below, and we dropped our bombs, some of them 4000-pounders, very quickly on the targets. We were so near that it was impossible to miss. When we had finished, some Italian Macchi 202's and CR.42's came up to attack, but they simply didn't have the speed to catch up to us."

A Canadian pilot in the rear of the Lancaster formation was attacked by two Italian fighters. He knocked down one of them in flames, while the other remained at a distance of a thousand yards, from which he kept firing discreetly, but with little effect. All the Lancasters returned from this sortie without a loss.

One of the toughest assignments ever handed to a bombing squadron was that given to the Lancaster outfit sent to bomb the dams controlling Germany's Moehne and Sorpe reservoirs, which hold about two-thirds of the water storage of the Ruhr, and the Eider Dam which controls the headwaters of the Weser and Fulda valleys and provides electric power for the Ruhr industries.

Crews of these Lancasters were given special training over a period of months. They were isolated from their companions and put to work to study the terrain which they were to attack. Their training included special rehearsals with dummy bombs to insure accuracy. Then one moonlight night they took off to effect what is probably the most damaging blow yet struck by airplane. The accurately placed bombs released 336,000,000 tons of water over the entire area which the dams were constructed to serve. Reconnaissance photographs taken after the raids show that large areas of the countryside were under water, and that all rail and road transport was crippled.

Approximately two hundred Lancasters figured in the R.A.F.'s raid on Duisburg in April, 1943. In a period of forty-five minutes as much as thirty tons of explosives were dropped every minute. According to the Air Ministry's communique, the Lancasters used on this raid were carrying a larger bomb load than ever had been carried previously. It was the fifty-ninth raid of the war on Duisburg, and cost the British seventeen bombers. It left the city a carpet of flames, however, and the attack was so heavy that Canadian pilots arriving in the second wave of attacking planes stated the first bombs had literally swamped Duisburg's defenses.

Lorient, Nazi submarine and naval base, was another objective of Lancaster bombers. After one raid in which the heavy block busters had been used, reconnaissance photographs revealed that ten acres of the naval arsenal had been devastated and 75 per cent of the offices of the German commandant had been completely gutted by fire. The pictures also showed damage to two power stations and three near-by sheds. One block of foundries had been demolished by a direct hit. Another direct hit on a large crane at the end of one of the slipways blew the crane out of sight—presumably into the sea.

The same set of photographs also showed that the civic gas tank had been destroyed, and a block of buildings containing the naval officers' club completely demolished. Altogether, the Lancasters had done a good job on Lorient.

Another British heavyweight has a pedigree to match the Lancaster, and, moreover, one that is closely associated with warplanes. This is the giant Halifax, the latest member of the Handley-Page family of planes which have served England so well in peace and war. It would be difficult indeed to imagine the British fighting a war without Handley-Pages, and since 1914 some type of Handley-Page bomber has been in R.A.F. service.

Handley-Page, their designer, is a big man with a leaning for big hats. He graduated from engineering to flying when his little workshop began to make gadgets and parts for airplane designers, most of whose planes would not fly. Handley-Page learned a great deal from these screwball ideas and quietly went to work to build his own machine. His first model actually flew, and he produced another in which he and other pilots began to barnstorm England with great profit, in competition with a number of French pilots who found the English exceedingly air-minded.

When war broke out, Handley-Page was asked by the British

Admiralty if he could build a bomber. His little factory was already busily engaged in making the standard BE-2e aircraft adopted by the R.F.C., but he went to work in 1914 and produced the first twin-engined biplane bomber on record. Like most Handley-Page machines, this bomber was far ahead of its time. No one can quite judge why the tall bulky designer had such an exact idea of what war in the air would be. His foresight was remarkable when you consider that he designed this bomber in the days when men in airplanes were firing at each other with shot guns.

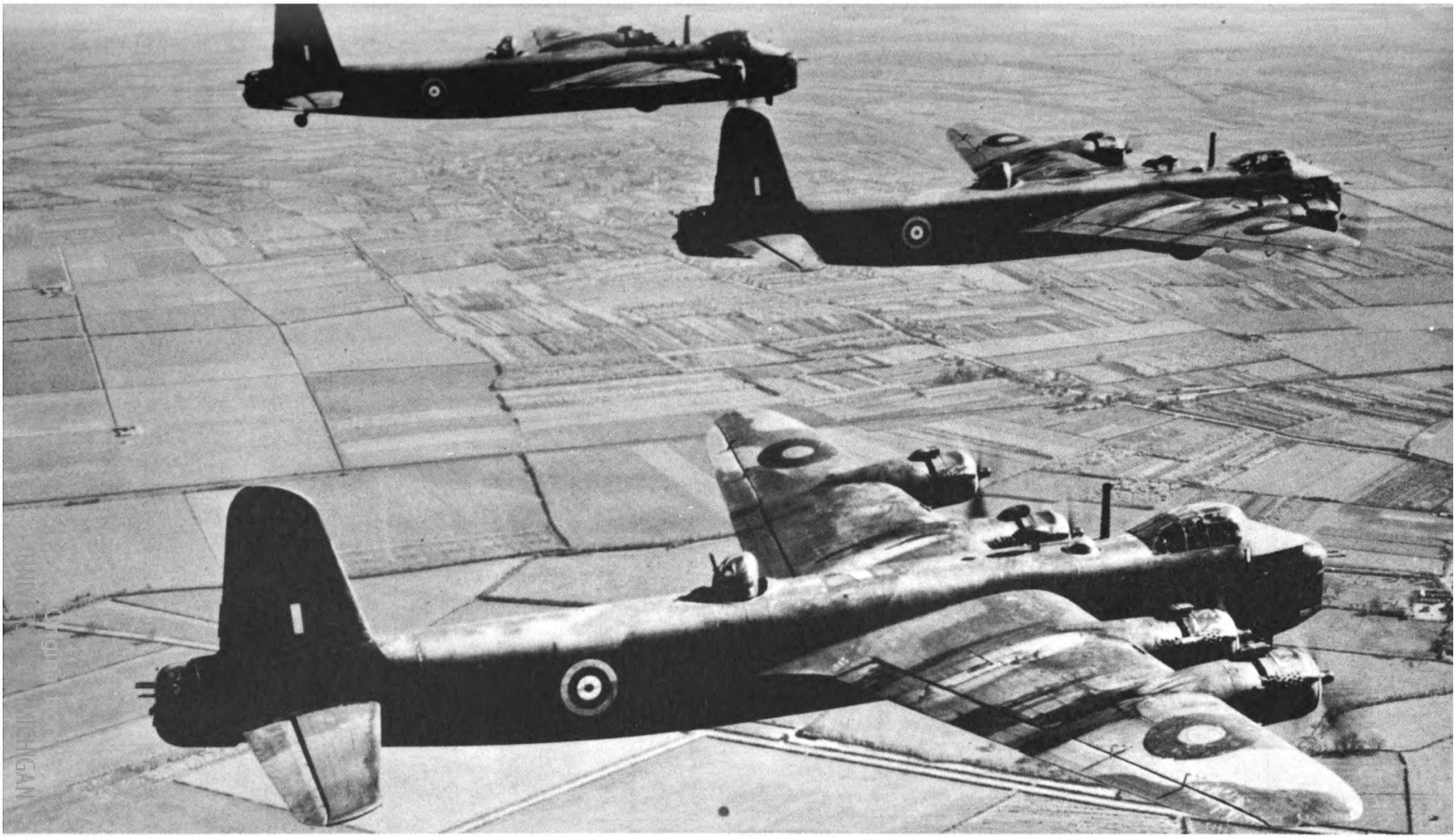
This Handley-Page bomber, which made its first flight in 1915, not only carried a ton of bombs—an unheard-of weight for those days—but its gasoline tanks and the fuselage around the pilots were actually armored. It was a long time, however, before the machine saw active duty. Actually it was not until 1917 that the first of the huge planes crossed the Channel, and this journey itself was a disaster. The pilots mistook the landmarks and landed in Germany, presenting the Germans with the most up-to-date aircraft of the time.

By the end of 1917, several squadrons of the twin-engined bombers were in action in France, the most notable bomber station being that near Dunkirk, from which the British Royal Naval Air Service unloaded an astonishing weight of bombs on the German north flank. Another squadron was operating from Greece, and the Handley-Pages were making numerous raids on Constantinople and on Bulgarian towns, which entailed a round trip of nearly a thousand miles.

In those days the British were slow in the development of air power, and it was not until dynamic "Boom" Trenchard became a power in the Air Ministry that the British began to increase the production of what was undoubtedly the best bomber of World War I.

Handley-Page continued to concentrate on military aircraft even during the slump that came after the war. His twin-engined Hyderabad won the Air Ministry's first prize for a commerical transport plane as far back as 1920 and became the first commercial airliner in general use in England and on Empire air routes. The Hyderabad was virtually a flying Methuselah. It never seemed to be out of date, and some of the type are probably still flying.

Toward the end of the twenties came the Hinaidi, an all-metal bomber that was somewhat in advance of its time, and the Harrow, one of the first big monoplane bombers, with a speed of over 200 miles per hour and a range of nearly two thousand miles. The Har-



Giant R.A.F. Stirlings are flying battleships. ***British Official Photograph.***

A Stirling is fueled by a petrol "bowser" before taking off for another attack on the enemy. *British Official Photograph.*

row was produced in comparatively large quantities and became the standard bomber of the R.A.F. When the Air Ministry began to look ahead and called for a bigger and more efficient bomber, Handley-Page produced a queer-looking machine known as the Hampden.

The Hampden, powered by two Bristol Pegasus engines with 980 hp. each, was able to carry ten thousand pounds of load, including crew and fuel, over 1500 miles, at a speed of 212 miles per hour. On this showing, it ranked exceptionally high for its time in bomber performance.

The Hampden had one quality that was later to play an important part in British aircraft construction. When the machine went to the drawing board, Handley-Page called in his production manager and they built their bomber on rather unorthodox lines. The long narrow fuselage was built in two parts, split down the center like a lobster, so that many operators working at the same time could fit all electrical equipment, oil lines, and accessories into the halves of the aircraft with considerable ease. When this work was completed, the two halves were welded together. Other parts of the plane were designed to be built in sections, which is a practice now prevalent in the British aircraft industry.

When the present war broke out, Hampdens were out of date, but the R.A.F. Bomber Command, faced with the problem of offsetting the terrific numbers of the Luftwaffe, had to use them. Like the Bristol Blenheims, the Hampdens distinguished themselves on many occasions. As a bomber the machine had many disadvantages, the main one being that it was exceedingly underarmed. Early models had only one gun firing to the rear, and one in front. This was rectified as soon as possible, but there was another difficulty which could not be overcome. The long fuselage was so narrow that the pilot and bombardier could not sit side by side, and if the pilot was killed or wounded, it was extremely difficult for the bombardier to get to the controls.

Then again the rear gunner was in a tough spot. He was in the narrowest part of the machine and could not budge. If he was built along ample lines, he could hardly breathe. Many jokes were made about the Hampden, which was at one time called "Fying Pencil" by the R.A.F., a name subsequently applied to the German Dorniers.

To a squadron of Hampdens fell the task of dealing an early heavy punch at German industry. Near the German marshaling yards at Hamm, the largest assembly of railroad lines in the world, were two aqueducts of the Dortmund-Ems Canal. Along this canal

passed a huge volume of river traffic from the Ruhr to the sea. It had been constructed at considerable cost and ingenuity, and these crossings presented a unique feature, two waterways over a river. The Germans were quick to recognize its vulnerability and arranged what was then the heaviest concentration of antiaircraft and night fighters around the area.

The Hampden pilots chosen for the raid had been put in training with many hours of reconnoitering over the area. They had flown first on pamphlet raids, and they had made special trips over the canal on their return from other bombing attacks. The night chosen for this attack was bright moonlight. Five of the planes were allocated for the task. They flew in two-minute intervals at a height of 300 feet.

The Germans had been warned of their approach, and twenty miles from their objective the first barrage of antiaircraft fire blazed into the skies. The pilots dived low, so low that the Germans could not readjust their guns to the altitude. Then the Hampdens went in over the target. The first machine was badly hit before it could release its bomb load. The second exploded. The third machine was set on fire and went down out of control.

The fourth Hampden flew in and dropped its bombs, to survive only by what one of the crew referred to as "the grace of God." Flight Lieutenant Brooke Learoyd was pilot of the fifth machine. He had been circling around the target watching the terrible punishment German antiaircraft was handing out to his comrades. The Germans had planned their defenses so that practically every approach to the aqueducts was a lane of antiaircraft fire. A machine wishing to venture over the target had to fly down one of these lanes. To escape from the searchlights coupled to the German guns was impossible.

Learoyd was cool and calculating as he made his run in. He approached the target at some 500 feet, and as soon as the antiaircraft fire opened up on him, he dived. He continued his approach at 150 feet. The few minutes before he came over the target were indescribable. He had to fly by instruments. The glare of nearly a thousand searchlights was blinding him, and the machine seemed to be flying through a hail of bullets. The crew heard ominous shattering noises, as fragments of shell and bullets struck the wings and fuselage. Above this din, the navigator was directing Learoyd over the target.

The gallant crew made it and dropped their bombs smack on the

aqueducts. Reconnaissance photographs later showed that no barges would cross the canal for many months.

When the Hampden arrived back over England, its wings and fuselage resembled a pepper pot. The navigator had been wounded. The undercarriage release gear had been shot away, and the pilot was faced with the alternatives of having his crew bail out or attempting a crash landing in the dark. He got the plane down safely, however, and became one of the first bomber pilots to be awarded the Victoria Cross.

Another member of a Hampden crew received Britain's highest award. Shortly after the fall of France, the Germans began to assemble invasion barges at every inlet on the European coast which could be used as a harbor. The R.A.F. began at once to plaster these invasion bases with bombs day and night. On one of these flights, Sergeant Hannah, a nineteen-year-old Glasgow boy, was radio operator for a Hampden. The machine had just dropped its bombs when a stream of incendiary shells sewed a trail of fire along the bottom of the narrow fuselage. One of the shells remaining in the bomb bay began to fill the interior of the plane with flames and smoke. To make matters worse, there were gas fumes. Hannah knew why. One of the gasoline tanks had been pierced and the gasoline was trickling along the outside of the fuselage, held to it by wind pressure.

At any moment the plane might explode. Then began one of those extraordinary epics of personal courage that have been a feature of the bombing crews of this war. Hannah was determined to fight the fire. He crawled along the fuselage to get to the fire extinguisher. It must have been like crawling along a narrow drainpipe with flames and smoke pouring on you from all angles. When he got halfway along, he was confronted by a solid wall of flame. His clothes were on fire, but he managed to continue, to discover that the rear gunner in his "dustbin" turret had been forced to bail out because of the heat.

The metal fixtures at the entrance of the turret were red-hot. Hannah set to work methodically with the fire extinguishers and after five minutes he had succeeded in putting out the fire in one section. Then he collapsed. He came to in the midst of a fire-works display. The heat of the flames was exploding the turret gunner's ammunition. Hannah quickly scooped up the drums and began pitching them through a gaping hole in the floor. Then he collapsed again. The intense heat of the aluminum floor, already melting,

brought him to, and he suddenly had the bright idea of using oxygen to revive himself.

The oxygen mask protecting his badly burned face, Hannah found enough strength to continue to battle the flames. He grabbed the plane's logbook and attacked them wherever he could. He was gradually fighting his way along to his own glass-covered cockpit. Here the situation was even worse. The wind was fanning the gas-charged flames into a blowtorch, and the entire front of his cockpit had been burned away.

Now he went after the flames like one possessed. He tossed out burning parts of the machine and beat the flames out with his hands. He pressed his body against the sides to smother the fire, and finally he had the satisfaction of seeing only smoke.

The Hampden got back to its base, and Hannah, who later said he looked more like a "smoked herring than a man," was rushed to a hospital to be treated for his severe burns. When he had sufficiently recovered, he went to Buckingham Palace to receive the Victoria Cross from the King.

With such an ancestry it might well be expected that the Halifax would have all the best qualities of a heavy bomber. The British pay it the compliment of stating that the Halifax is "a central peg in Britain's air strategy, having been built *round its bomb bays.*" When you look at the well-designed bomber it is difficult to realize that it is as large as the Stirling, for the simple reason that it is beautifully proportioned, with slim wings and graceful fuselage. It is difficult as well to appreciate that twenty-two feet of this fuselage together with the center section of the wings are packed with bombs, which emerge from twenty-two separate bomb doors. The Halifax is definitely the "glamor boy" of British heavies in appearance, but for some reason or other it has never captured the imagination of the public on either side of the Atlantic, perhaps because it bears the same name as Lord Halifax, the British ex-foreign minister who symbolizes the Chamberlain regime to the British. Actually the big machine was named after the city of Halifax in Yorkshire famed for its woolens and textiles.

Designed to be an all-round ship, the Halifax is probably the nearest approach to the American Flying Fortress in the matter of defensive armament and armor. It literally bristles with guns. There is a tail turret, and center turret after the pilot's cabin, and a forward-firing turret, making eight .30-calibers in all, with the possibility of the addition of heavier weapons in recent types. It has armor exceed-

ing one thousand pounds and the leading edges of the wings are equipped for armor and a special device for cutting the cables of barrage balloons. Its bomb load is in the neighborhood of six tons, but its speed with its four 1175-hp. Rolls-Royce Merlins is in the neighborhood of 270 miles per hour. The Halifax excels over the Stirling and the Lancaster in having a greater range. The men who fly in a Halifax are particularly happy about the heating. Intense cold is the enemy of bombardment aviation, and many crews have suffered terrible agonies when their electrically heated suits have been out of action during operations. Halifax crews have none of this inconvenience, and, next to the Mosquito, the Handley-Page Halifax is the warmest and most comfortable of all bombers. One disadvantage, however, is that de-icers are not fitted to the wings because of the armor plating previously mentioned. Large numbers of planes have been lost through ice on the wings.

Its crew consists of two pilots, a navigator who is also the bomb aimer, radio operator, flight engineer, and two gunners. Although primarily designed for night work the Halifaxes have made a number of successful daylight sorties. The most outstanding of these was a raid by an unescorted force of Halifaxes on the *Scharnhorst* at La Pallice, in western France. The big bombers flying in tight formation came over the target at medium altitude, and were immediately attacked by droves of German fighters. The Germans doubtless expected an easy victory, especially as the bomber formations were unescorted by British fighter planes. The first volley of fire from the Halifaxes knocked several of the attacking fighters out of action. One Me-109 dived into the middle of the Halifax formation, and went down in flames after having narrowly missed colliding with one of the bombers.

While the gunners were fighting off a second attack by the fighters, the Halifax pilots went in for their bombing run, and scored two direct hits on the battleship. One section flying lower than the others shot down a German fighter as it was rising to intercept. After the bombing raid which left the dock area wreathed in smoke the Halifaxes reformed and fought their way back through another fighter plane attack, reaching their home base with many machines damaged, crew men wounded, but without loss.

On night raids the Halifaxes have proved they are as tough as most planes when it comes to getting home. After a visit to Berlin, one Halifax captain found himself with three of his crew wounded, his co-pilot dead, and one of his engines out of commission. To make

matters worse the tail gunner reported that a German night fighter was creeping up on them. "Keep going as you are, Sir," called the gunner. "I'm going to take a shot at him." Presently he called again, "I think I got him, Sir."

A few minutes later another night fighter made an attack. His bullets set one of the three remaining engines on fire. The tail gunner spotted the plane as it came in to attack and drove it off. The Halifax pilot had to consider whether it was a case for bailing out or trying to make the English Channel. He sent the bomb aimer back to report on the wounded men. He returned to say they all wanted to stay, to get home. "You've got to make it, Captain," said the turret gunner, who had fixed a tourniquet on his leg shattered by a 20-mm. shell. "My landlady is saving an egg for me for breakfast tomorrow."

The pilot decided to keep the machine flying. Over the coast of France the Halifax ran into more trouble, searchlights and flak. One shell burst under the tail, and put the machine in a crazy dive, from which the pilot righted it with difficulty. The altimeter then showed they were flying at 1000 feet, and with two engines running efficiently and one spluttering, the prospect of gaining altitude was not good. "It looks as if we'll have to ditch, boys," he announced to the crew. Only one answered, the tail gunner. "I think it would be better if we touched dry land, Sir, we'll make it."

It does not take a bomber traveling at 250 miles per hour long to cross the narrow thread of water separating France from England, but this particular crossing was, as one of the crew afterwards described it, as exciting and fast as a slow bicycle race. The big plane seemed to be stalling at every second, but actually it was gaining height, and arrived at an R.A.F. airfield, where the pilot made a belly landing on discovering that his landing gear had been damaged by the last burst of flak.

Halifaxes have featured in many of the big raids on Berlin, but for the strangest reason they are rarely mentioned in the communiques. The glory goes to the Lancasters and the Stirlings. The men who fly the Halifaxes don't mind, however. They know they have a plane that will do a good job at high speed, and they say that beside a Halifax the Lancaster looks like a mail truck, but that is just R.A.F. kidding.

The Lancaster is undoubtedly the white-haired boy of the R.A.F.'s heavies, and its name appears on more communiques than any others, but usually wherever the Lancasters go, the Halifaxes are

there as well. Berlin, Hamburg, Cologne, Düsseldorf, Mannheim, and Kiel are only a few of the German centers to come under the shadow of the wings of this big bomber.

Chapter Six

STIRLING, WELLINGTON, AND WHITLEY

THE third outstanding four-engined British heavy is the Short Stirling, made by the firm of Short Brothers, one of the oldest manufacturers of airplanes in England.

The firm was founded by the two brothers Eustace and Oswald Short, who were making balloons many years before airplanes were flying. During World War I, the Shorts built seaplanes for the British Admiralty, and afterwards turned their attention to the production of large flying boats with which the British intended to link their Empire by air. These were known as the G-type flying boat, and considerable comment was caused when these craft, whose hulls had been built at Rochester, on the Medway, by men and women descended from the craftsmen who built the ships with which Drake defeated the Spanish Armada, were launched down shipways.

Few of these boats ever got to the Empire air routes. The R.A.F. wanted them as long-range patrol bombers. Short Brothers were determined to build a flying boat for trans-Atlantic air-mail service, however, and they created a machine known as the "Pickaback." This consisted of one airplane on top of another. The larger aircraft used the power of the top and smaller plane for the take-off. Once in the air, the small plane was detached and the bigger machine proceeded under its own power. One of these machines made the flight from England to America in record time.

When the Air Ministry called for their B36 specifications, someone suggested that the Short Sunderland, or G-type, flying boat was a good design for a bomber. Short engineers went to work and did what they had previously done in building their flying boats, con-

structing a flying mock-up of the proposed giant, complete with four tiny Pobjoy engines and with seats for two test pilots only. The flying mock-up has the great advantage of pre-testing the machine before the final blueprints are made, and as a result of these flying mock-ups, both the Sunderland and Stirling are credited with being exceedingly efficient large airplanes.

The Stirling is a midwing monoplane designed to be powered either by four Bristol Hercules or by four Wright Cyclone engines. When it made its first appearance, it was the heaviest armored bomber in the air. The Short designers had made considerable improvement on their slow and ponderous Sunderland. Everything in the big new bomber was of metal, and the bomb load was estimated to be in the vicinity of twenty thousand pounds. The first machines carried a crew of seven and were armed with eight guns in power-operated turrets, but recently the crew has been increased by an additional member.

The Stirling is not a pretty machine to look at. It has a square, thick, fuselage with a decided bump on the nose and is typical of British design. Seen from close by, this plane is a real giant. Its landing wheels are six feet in diameter, and it is twenty-two feet high.

The Stirling carries its bomb load, which equals that of nine Blenheims, in three electrically operated bomb racks which run almost the entire length of the fuselage. When the Stirling first went into action in 1941, many of the crews had previously been on Hampdens and Wellingtons. They were immensely pleased with the roominess of their new machines. The interior of the Stirling is so generous that the crew can walk around with perfect ease. There is a corridor extending the length of the machine, leading to the quarters of the tail gunner, who in most bombers is quite isolated from his fellows. All the crew are provided with comfortable armchairs and the flight engineer sits behind the pilots with a separate panel for his own instruments.

The Stirling was a distinct surprise to R.A.F. pilots when they first flew her. They had expected such a large machine to be heavy and unwieldy, but owing to the high wing loading, the Stirling proved to be extremely maneuverable. Certain criticisms have been leveled at the big bomber, one being that in spite of its flaps, it lands at high speed, about 120 miles per hour. When it became known that the first model of the Stirling crashed on its test flight, this landing speed became the principal criticism against the bomber, but nevertheless pilots flying the big ships soon became enthusiastic.

Although designed primarily as a bomber, considerable attention was paid to the arrangement of armament and the supply of ammunition in the Stirling. When attacked, this huge plane goes into action rather like a battleship. One of the crew directs the fire of all the gunners to whom ammunition is fed by means of a conveyor belt.

When these aircraft made their debut, they were as formidable to the German fighter pilot as were our own Flying Fortresses. On one daylight raid over northern France, a Stirling was attacked by three Messerschmitt 109's. The Stirling pilot turned his nose to the attacking fighters in approved combat fashion, and gunners quickly downed two of them. As the ship went round in a tight turn, the turret gunner accounted for the third German fighter, and the Stirling returned safely with nothing more in the way of damage than a few bullet holes in the wings.

During the days when it was essential to use the Stirling for day operations, one of the squadrons piled up a record of having definitely destroyed twenty-three German fighter planes in a single month's operations.

One of the most unusual encounters between German fighters and a Stirling took place during a raid on Brest in December, 1941. As it made its way to the target, the Stirling squadron was attacked by a squadron of twelve Messerschmitts. One of the Stirlings became separated from its formation, and the German planes concentrated on it. The crew of the bomber kept up such a blaze of accurate fire that three of the German planes went down in flames. The remaining nine rallied after the first attack and came down upon the bomber again. One by one they were beaten off. For the next attack, five returned. Again the Stirling gunners replied, and the Stirling was still flying. After this attack, the Germans decided to call it a day and the big machine went in over the target with its bombs.

How they managed it, is one of the mysteries of bombardment in this war. The Stirling had taken terrible punishment. One of the port engines was out of action. The tail plane had been severely damaged, and the undercarriage was dangling below the fuselage. When the machine got back over its own airfield in England, the interior of the fuselage was reaking with gas and oil fumes, and the oil was stained with blood. Three of the crew were wounded, and one was already dead.

As the Stirling came down, things began to happen. The starboard wing fell off in flames when the wheels touched the ground. All of

the giant tires had been punctured. Minus the starboard wing, the big bomber turned over on its side and began to burn fiercely. The young pilot stayed at his post and methodically ordered the crew to evacuate. They brought out the wounded and the dead man. Said the captain afterwards, commenting on the raid: "These machines are tough. Somehow I never thought I'd get back."

Another Stirling taking part in that action is known by a name as well as by an identification letter. This is "MacRobert's Reply." Lady MacRobert, a fine type of Scottish woman, lost first one son, then another, and then a third in action with the R.A.F. Each time the mailman brought the sad tidings, the courageous lady would make her reply by buying a fighter plane or a bomber to strike back at Hitler. "MacRobert's Reply" was in memory of two of her sons. Five times the defending Me-109's attacked the big bomber over Brest, and each time they were beaten off. When the crew returned to England, they were able to report two more German fighters downed and one damaged. MacRobert had replied.

A daylight attack on enemy shipping off the island of Borkum, in which eight Messerschmitts attacked a small section of Stirlings, saw four of the German planes shot down and several others damaged. The fight lasted twenty-five minutes. One of the Stirlings had been damaged by a direct hit from flak before the engagement opened. It fought the battle with its bomb doors hanging open and with two engines out of commission. Its gunners accounted for one German fighter, and the pilot brought the machine home safely.

Stirlings have been used extensively on bombing raids over Berlin and Italy. Many of them have been shot down, but again and again they have demonstrated their toughness and justified the belief of their designers in the advisability of creating a battleship of the air. Whether the British are likely to build any new bomber types during this war is a matter of conjecture, but if this industrial miracle should be achieved, in all probability the super-bomber will follow closely along the lines of the sturdy Stirling.

The oldest of Britain's heavy bombers still flying is the doughty old Vickers Wellington, named after the famous duke who took on the arduous task of beating Napoleon on land, and who because of his stern, tough, and unrelenting determination to see the task through became known as the Iron Duke. To Wellington is attributed the axiom that the Battle of Waterloo was won on the playing fields of Eton. In the case of the Wellington bomber, it may well

be said that part of the air battle for Germany was won in the shipyards, for the two-engined Wellington comes from a line of warplanes, like its companion the Spitfire, that were mass-produced in the shipyards of England, Scotland, and northern Ireland.

Even before World War I, the Vickers Company, Britain's leading armament manufacturers, was building airplanes and teaching soldiers to fly. The first warplane of note produced by this company was a little pusher biplane known as the Vickers "Gun Bus." It was the first machine to be fitted with a machine gun in the nose, and it did remarkable work in the early days of 1915. From it, the British evolved the FE-2b, a larger pusher biplane which later became a night bomber.

When the British Air Ministry in 1917 called for machines capable of bombing Germany in retaliation for the Gotha attacks on England, the Vickers Company produced a twin-engined heavy bomber which was called the Vimy. Although the machine arrived in action too late to be used effectively, it achieved fame for the name of Vickers and for the British aircraft industry by making the first nonstop west-to-east Atlantic crossing in 1919, piloted by John Alcock and Arthur Whitten-Brown.

Another Vimy flew to Australia from England, and the Vickers designers decided to concentrate on military planes, in spite of the slump that hit the aircraft industry after the Armistice. The Vimy was followed by the Vernon and the Virginia; the latter became the standard heavyweight bomber of the R.A.F. and at the outbreak of the present war was still in operation as a transport and training plane.

In 1939, a squadron of Wellingtons took part in the first daylight raid on Bremen, and since then the "Wimpies," as the R.A.F. affectionately calls the big bombers, have visited practically every target bombed by the R.A.F. They undertook the early raids on Berlin, they fly with the four-engined heavies over the Ruhr, and they dump tons of explosives on Emden, Hamburg, Keil, and Wilhelmshaven. Their geodetic or woven construction, rather like basket weave in steel, makes them the toughest of the older bombers. Wellingtons have returned from raids with fuselages and wings practically stripped, apparently unflyable. One Wellington returned from Bremen and landed safely in England without flaps, with its undercarriage out of action. It had a hole big enough for two men to pass through in the starboard wing, and over two thousand holes in the fuselage. Nine feet of fabric had been burned away forward

from the rear turret. It had half a fin, half a rudder. Over the target it had been little more than a torch, but it "flew" home.

The honors list of Wellington air crews is as high as any in the R.A.F. Even if losses of the old bomber have been high, it is still in service on all fronts, and still in production. It is likely to end the war faster and more formidable than ever, the result of good basic design.

One task handled by the Wellingtons has been mine laying and the extremely risky job of neutralizing German magnetic mines in British coastal waters. To effect this, the bombers were fitted with magnetic hoops which, working on the "degauzing" principal employed by ships, release the mines from their moorings under the water and cause them to rise to the surface.

The Wellington may well finish the war with the distinction of having done every possible kind of job that can be asked of an airplane. Recent reports from the Mediterranean battle area reveal that in addition to pounding Sicily and Naples, and undertaking routine bombing missions, the Wellingtons have been fitted with torpedo racks and used for long-range attacks against Axis shipping. Other Wellingtons are being used as convoy escorts, submarine hunters, transport and hospital planes.

The Armstrong-Whitworth Whitley was built in 1935 and is still in service with the R.A.F. Coastal Command. It is a descendant of the R.A.F.'s Big Ack fighter-reconnaissance-bomber of World War I, and cousin of the three-engined Argosy airliners used by British Imperial Airways for many years prior to this war. The Whitley is an efficiently armed, metal and fabric bomber, with a crew of five and capable of carrying a substantial load. It first appeared with two 850-hp. radial engines, but was later fitted with two 1145-hp. Rolls-Royce Merlins, which have brought its speed up to something over 250 miles per hour. It has a service ceiling of 26,000 feet and a maximum range of 2000 miles.

The Whitley began its service in this war by making the famous pamphlet raids over Germany. It took part in the first bombing assaults on German troops and installations during the Battle of France, and later began carrying its 4000-pound bomb load deep into Germany, by day as well as by night. The majority of these aircraft are now being used to transport troops and to train paratroopers. The Whitley was the British bomber best known to the

public in England during the Battle of Britain, because it could be easily identified by its appearance of flying nose downwards.

Whitleys have featured in many battles with German fighter planes, and although the machine was primarily intended for bombardment, the Whitley gunners have chalked up numerous victories over Me-109's and FW-190's.

There is one story told in the messes of the R.A.F. Bomber Command which has an ironic touch. One morning a Whitley was dispatched to search for the crew of another bomber which had been shot down by German antiaircraft fire. While flying over the coast of France, the Whitley pilot sighted three German Ju-88's which immediately sailed in to attack the British bomber. The German pilots probably thought this would be an easy job because between the three of them there were twelve machine guns and cannon to the Whitley's six small-caliber guns.

The Junkers 88 is a fast, fairly maneuverable machine which was used as the spearhead in Germany's attack on Britain. The Whitley gunners opened fire on all three planes simultaneously, and as a result of their first burst one of the Junkers planes went down smoking. The others began to circle around over the Whitley, making furious diving passes at it.

A dogfight between bombers is not in the book of rules, but these three heavy ships continued to fight it out, turning and weaving and diving like fighter planes. The Whitley was taking severe punishment. Her first casualties were the second pilot, Flight Officer McHarrie, and Sergeant Russell, who was under instruction. Both were wounded in the leg. Then the rear gunner was hit. Immediately McHarrie crawled to the rear and took over his gun. He seemed to have beginner's luck, because he got the two remaining Junkers with his first burst.

While the crew were patching up the wounded, the Whitley continued its search. Presently, on the sea below, the pilot spotted a human figure clinging to a lifebuoy. He swept down to investigate and saw that it was a German pilot. A short distance away were two British destroyers which had evidently shot down his machine. The Whitley signaled to the destroyers to come to the aid of the German, and circled over them as they churned their way through the sea to effect the rescue.

This errand of mercy almost ended in disaster, however, for three FW-190's dropped out of the sky and began to make rings

around the Whitley. They attacked from underneath, from stern, from starboard. Shells from their cannon splashed the water all around the unfortunate German pilot.

The Whitley crew were not in good shape. Sergeant Russell was helpless because of his leg wounds. McHarrie was so weak from loss of blood that he could barely drag himself around. He made it to the rear gun once more and opened fire. Russell crawled along and began handing him up drums of ammunition. The other gunner, Pilot Officer Stuart, of Montreal, was doing good work. Two of the German fighters came in at close range, to be met by a stream of bullets from Stuart's gun. One of them went out of control, then into the sea in a headlong dive; the other, to use Stuart's words, "staggered away across the sky." At this, the third turned tail and broke off the engagement.

Said McHarrie, who had proved his skill as an aerial gunner: "He was heading toward home, but it isn't likely he got there, because there was smoke pouring from his engine."

The Whitley was now showing signs of combat fatigue. It had received severe damage in the wings and fuselage, and halfway home, one of the engines spluttered and died out. The flight continued on the other engine. Then the pilot discovered that the hydraulic system which controls the undercarriage had been damaged. This meant that the huge craft would have to make a belly landing. Pilot Officer Gordon Day, the navigator, had been trained in hydraulics in civilian life, however, and he volunteered to inspect the "works," while the pilot circled the airfield, to see if anything could be done.

Presently he announced with a grin that in a few minutes he would have everything under control. Using a hand pump, he managed to substitute air for the hydraulic fluid, and one of the gunners after poking his head out at the side was able to announce to the pilot that the undercarriage was down. The Whitley landed safely, after what the crew called "quite an adventure."

Before the war ends, there will be new heavy bombers, but we must never forget the tremendous task undertaken by these early models. We should be eternally grateful that in 1935–36 men on both sides of the Atlantic began to turn their attention to problems about which the man in the street and the politician never gave a thought. We should be thankful too that the Nazi military brains did not give as much attention to heavy bombers as to dive bombers and tanks.

Chapter Seven

AMERICAN MEDIUM BOMBERS

ONE of the strangest aspects of United States military aviation is that we went into war not only with the best long-range bombers, but also with a definite superiority in medium and lightweight bombers, in spite of the fact that between wars we were an extremely nonbelligerent nation with the very obvious need for long-range heavies to protect the vast coastline and outlying islands.

American medium bombers are the best in the world. One reason is that they were developed side by side with our commercial airplanes, which had to have speed and range in order to cope with American air transport problems.

For the steady development of its medium bombers, America owes a considerable debt to the late General Billy Mitchell, who in the last war was commander of the largest tactical bombing air force put under a single command at that date. His force consisted of Americans flying British and French machines, as well as British and French squadrons. Mitchell returned from war with very advanced ideas on the potentialities of bombing, and although no American-designed bombers had been in action in France during World War I, he fostered the development of the twin-motored bomber.

Mitchell used Glenn Martin bombers in his memorable attempt off the Virginia Capes to prove that the airplane could master the battleship, and it is undoubtedly due to his doctrines that the United States Army continued to press development of these exceedingly useful craft.

In one way the American medium bomber is responsible for the air supremacy of the United Nations. This is a personal opinion, and you must take it for what it is worth, but I am convinced that if the United States had not demonstrated so liberally the possibilities of fast twin-motored bombers between wars, the German Reich might have modeled its Luftwaffe on the British plans, building heavy bombers rather than concentrating on a standard design for all-round bombers such as the two-engined Dornier 217. The Germans are excellent engineers and improvers. They improved the tank beyond measure, and turned it into a highly efficient and deadly

weapon, while their airliners followed closely on the designs of the French aircraft.

When faced with the problem of mass-producing an air arm, they looked around carefully. They had always had vast respect for America and American methods. German aircraft engineers and students began flooding into the United States. To Germany they sent or brought reports of the remarkable progress made over here in commercial and military airplanes. Our airliners were appreciably faster than anything Europe was producing, our medium bombers had an edge on the planes of the world. Back to the Fatherland went the snoopers and improvers, with the thought that if America could build such efficient medium bombers, Germany could go them one better.

British planes were good, but slow. Their aero engines were excellent, but in bomber design and in production they seemed far behind. Goering, Milch, and Udet decided to follow the "American Plan," paying particular attention to the dive bomber perfected by the American Navy and to the Army's medium bomber which had been brought to a high standard of development by Martin, Curtiss, and Douglas.

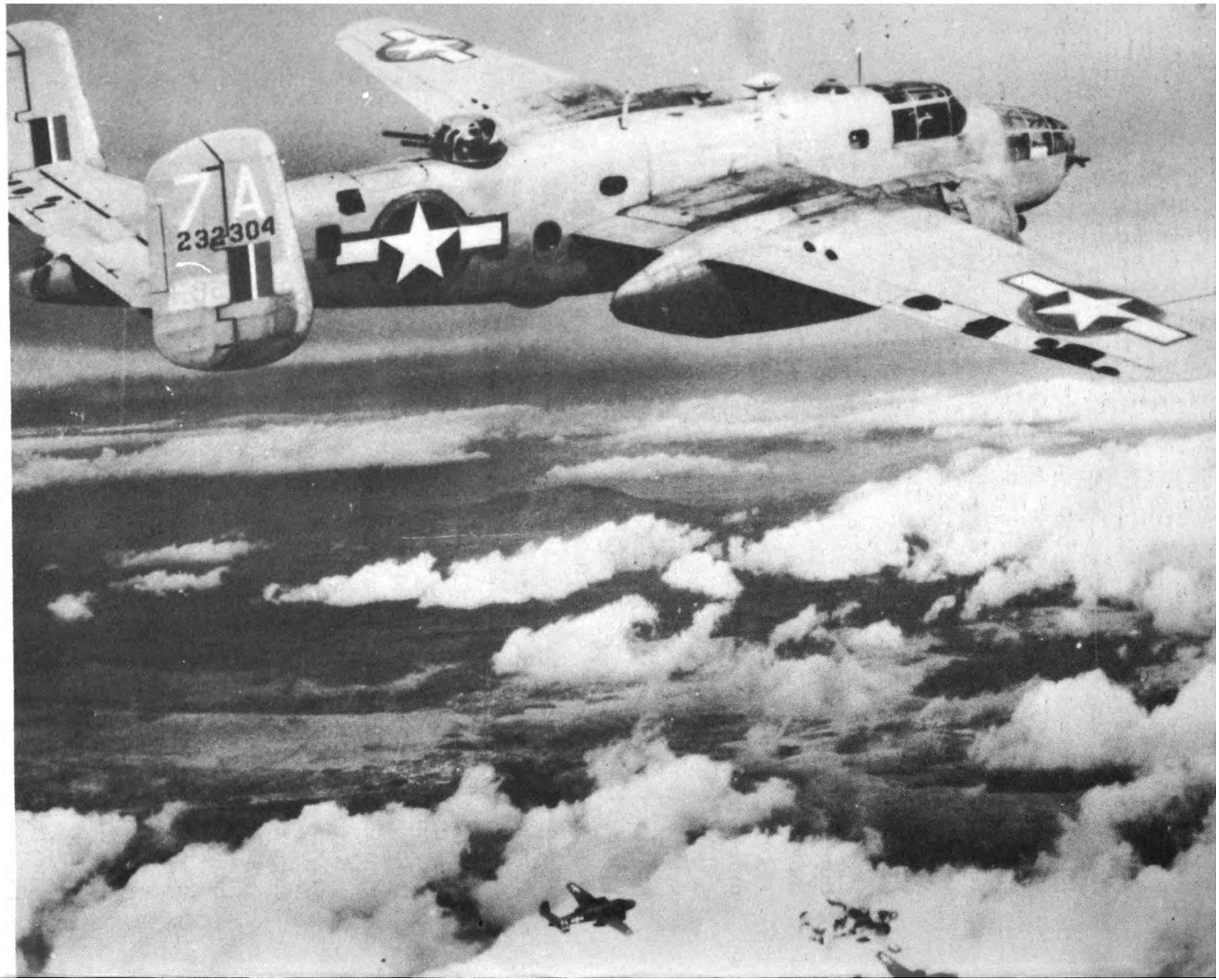
The medium, or middle-range bomber, call it whichever you wish, is the war's aerial maid-of-all-work. Because of this, it is the most interesting of all planes. Certainly it is the nearest to the perfect airplane dreamed up by designers. To be efficient, it must have a great deal of all the qualities necessary for war: speed, weight capacity, defensive armor, and offensive and defensive armament. It is the happy medium between the fighter plane and the heavy bomber. Into its make-up designers have crowded all they can of the best of the two types.

In considering airplanes designed for military use, it must be remembered that each is a victim of compromise. The designer of the fighter plane works to achieve speed, altitude, and maneuverability, above all else, and the producer of the heavy bomber strives to enable his product to carry the greatest possible load, with speed and altitude secondary considerations.

In the medium bomber, compromise on any one score is less violent. With increasingly powerful engines at his disposal and augmented knowledge of aerodynamics, absolved from the necessity of designing for excessive high-altitude flying, the designer can get as near to the perfect airplane as is humanly possible.

Three early bomber types were to have a lasting influence on

B-26 Marauders smash a causeway and bomb military installations in North Africa. Note smoke pall in lower center, and bursts on the promontory and in the water showing how bombs have "straddled" water. ***Glenn L. Martin Co.***



B-25 Mitchells fly in a bombing raid over the Adriatic coastal town of Sibenik, Yugoslavia. The plane in the foreground is a battle-scarred veteran, with black patches covering flak holes from previous raid. *U. S. Army Air Forces.*

American medium bomber design. They were the Martin bomber designed by Glenn Martin for use in World War I (had it lasted long enough for the machines to be shipped to France), the Curtiss Condor of 1924, and the 100-hp., twin-engined Douglas of 1926.

Two American medium bombers stand out wings and tail above the crowd, including the famed German Dornier 217 held by many writers to be the best bomber in its class. These are the Martin Marauder (B-26) and the North American Mitchell (B-25), hero of the memorable raid on Tokyo.

The Marauder is a pretty thing, lean and deadly with hardly a bump to mar the streamlining of its fuselage. It is a high-winged monoplane powered by two Pratt and Whitney Double Wasps with 1850 hp. each, which enable it to whip along at better than 325 miles per hour carrying some two thousand pounds of bombs.

The secret of the Marauder is undoubtedly a long pedigree developed from a good basic design. It has an exceptionally high wing loading, and its wing span is three feet longer than that of the Dornier 217. It has several distinct advantages over its German rival, one being that it is decidedly more maneuverable and can take off unassisted with full load, whereas the Do-217, which must do duty as a high-altitude bomber, has to be catapulted.

Comparisons between bombers, however, are unprofitable. In the case of these two planes, whereas the Marauder is designed for a particular purpose, medium bombing, the unhappy Dornier is intended for use as a dive bomber, photographic and reconnaissance bomber, a night bomber, and a fighter.

The Marauder comes of a line of airplanes that started with the Martin bomber of 1918 which was fitted with two 400-hp. Liberty engines. Its cousins are the big Martin patrol bombers, the Mariner and the gigantic seventy-ton Mars; the Maryland, a fighter-bomber built for the French; also the Baltimore, which was built specially for the British.

The Army requested the Glenn Martin Company to build a medium bomber that could carry a heavy bomb load as fast as a fighter, and could defend itself and fight like a fighter plane. The specification was a headache, but the Martin engineers tackled it. They clipped the wings of the plane until it looked like a racer. Even experts began to say that it was a suicide affair because of its high landing speed.

While working on the experimental models, the manufacturers were so sold on the quality of their product that they undertook the

responsibility of tooling up for mass production, although the Army had only placed an order for a small quantity.

When the machine was delivered to the Army, it justified the confidence of its designers. It underwent tests as a medium-altitude bomber, as a low-flying attack bomber, dropping parachute bombs, as a troop strafer, as a torpedo plane, as a submarine strafer—in fact, an All-American warplane! The Army liked the newcomer and larger orders were placed at once.

The first news we had of Marauders going into action was in April, 1942, when they were used as fighters in the defense of Australia. The heavily armed bombers tangled with the Japanese bombers and fighters and contributed largely to the turning back of the invading squadrons. A month later Marauders were carrying the offensive to the Japs by dumping tons of high explosives on Port Moresby and returning without a single loss. Then came the Japanese invasion of the Aleutians. Land-based Marauders with torpedoes slung under their bellies roared down to attack the Jap fleet that had been spotted by a Catalina. A squadron under Captain M. A. Beth sank a Japanese cruiser and damaged an aircraft carrier.

At Midway, the versatile bombers repeated their performance and assisted Navy dive bombers and torpedo bombers in inflicting severe losses upon the enemy. As deliveries increased, the Marauders began to appear on battlefronts all over the world. In the Pacific they bombed Jap warships from deck level, skip bombed, and strafed. They got Zero after Zero, and the planes survived the most terrible punishment. Three Marauders engaged in a dogfight with twelve Zeros and came through without a loss, while five of the Jap planes were shot down into the sea and the others were hit. One Marauder returned to its base looking like a flying pepper pot; but still it returned and was soon flying and airworthy again.

When the United Nations unleashed the full might of their aerial offensive against the Germans in North Africa, and later in Tunisia, Marauders attacked in force. They carried 4000-pound bombs to Bengasi, to Tripoli, and Bizerte. Attacked by swarms of Me-109's and FW-190's, they shook them off after inflicting serious damage. When Tunis fell, they carried their bombs to Sicily and Sardinia, and staged a daring daylight raid on Naples, which was described as one of the most successful attacks executed to date by the United States Army Air Forces.

A British spokesman in Cairo described the Marauder as a "lightweight boxer with a heavyweight punch." A German pilot who was

shot down by a Martin Marauder and later saw his squadron of Stukas annihilated on the ground by a furious mass attack by the same machines, is said to have lamented, "We never imagined there could be a plane like that." Because of their speed and heavy armament, Marauders in formation are capable of undertaking daylight raids without fighter escort.

In the same class as the Martin B-26 Marauder, is the North American B-25 Mitchell, hero of the Tokyo raid. The Mitchell is not such a handsome-looking bomber as the Marauder. It has a larger wing span, twin tail, and what seems an extraordinarily long nose. Slightly slower than the Martin, it carries a crew of five and is well armed with .50-caliber guns in the nose and tail, and possibly a belly turret. Like the Marauder, it has a tricycle landing gear, is of rugged construction, and heavily armored.

The Mitchell is a descendant of the NA-21 Dragon bomber which was distinguished by its heavily armed gun turret. The Dragon appeared in 1937, but it was not produced in quantity. Later, North American produced the NA-40 for the Army. Although the NA-40 came well within the Army specifications, it was decided to build a new and better ship. The Army was in a hurry, and the North American staff of designers were given only six weeks to complete their work on the new aircraft design. Eighty-three specifications for the medium bomber were submitted to the Army by various designers, and North American Aviation's design was one of the two awarded the contract.

This was in September, 1939, shortly after the outbreak of war in Europe. The first B-25 was ready for its Army tests on Independence Day, 1940, and it completed its tests on August nineteenth. The Army immediately placed a substantial order, and as soon as the machine was put into production, modifications of the design were begun. The present B-25 has undergone more than a thousand improvements, some of the most notable being the addition of extra armor plate, the redesigning of the fuel tanks, and modification of the rear fuselage in order to accommodate the power-driven gun turrets.

General Arnold described the Mitchell as "One of the speediest bombers in the world, carrying a very healthy load of bombs, and capable of operating at a high altitude—it can definitely out-perform even the hopped-up version of the Dornier 217 and Heinkel 111K."

These Mitchell bombers are now being mass-produced on a scale

similar to that employed by General Motors for automobile production. They have been in action on many fronts. In the North African campaign they took part in the terrific onslaught which carved a four-mile bomb barrage through German defenses in Tunisia. In New Guinea, the B-25's were largely responsible for preventing the Japanese from landing troops on the coast of that island. On one raid, they shot down five Zeros, damaged five transports, and scored direct hits on two escorting warships. Later the same outfit located a Japanese destroyer and two smaller ships and sank all three. A picture of a Mitchell operating from a Pacific base shows it bearing four Japanese flags for ships sunk, nine rising suns for Zeros shot down, and seventeen bombs to indicate the number of raids successfully undertaken. According to the United States office of War Information, "No other airplane of its type in friendly or enemy air forces is known to equal it!"

That the Mitchells can take punishment is shown by the few stories that come through the stringent censorship on battle performances of individual planes.

One Mitchell taking part in a daylight raid over Marsala Harbor in Sicily was attacked by a large number of German and Italian fighters. After the gunners had beaten off the enemy, three of the crew were wounded. The navigator's compartment was on fire, the bomb-bay doors were hanging open, through damage to the hydraulic system. The right elevator was shot away, and the right aileron resembled a sieve. When the crew had succeeded in putting out the flames in the navigator's cabin, the starboard engine burst into flames. The co-pilot managed to extinguish this by using the automatic fire extinguisher, and the wounded bomber set off for home. Ninety miles from the North African coast another blaze started up in the navigator's compartment. Sergeant Thomas, the radio operator, who had been wounded in both ankles, managed to crawl across the bomb bay and grab an extinguisher. It did not work, and the interior of the plane filled up with choking black smoke as the fire licked up the sides of the fuselage, burning everything inflammable.

Thomas and Sergeant Donahue, the bombardier, who was also wounded, stripped off their jackets and tried to beat out the fire. They were fighting a desperate battle against time. If the fire gained the upper hand and got to the gasoline tanks, the whole ship would explode. For fifteen or twenty minutes they struggled with everything they had, and finally they managed to overcome the fire.

As they lay exhausted on the sweltering floor of the bomber, the

remaining engine began to tire, and the Mitchell lost height rapidly. The pilot decided to make a crash landing on the beach until he remembered that the bomb-bay doors were dangling. Donahue was still able to move, so he volunteered to wind up the bomb bays with the emergency cranking handle. He crawled over and went to work. When he had closed the doors, the safety catch to secure them was out of order, so the gallant sergeant removed his belt and strapped the crank securely. He went aft, then, to attend to the tail gunner who was unconscious from wounds. The pilot went in to land and in a few seconds the Mitchell was ploughing its way along the soft sand of the beach. When the crew got out and looked at their machine, they could not believe it had flown them back from their target. It was charred and gnawed and frayed, but it had come through.

Another Mitchell, raiding Italy, was caught in a furious anti-aircraft barrage. Explosions shattered the conduits housing the throttle and propeller pitch controls. The plane went into a dive, and the pilot found he could not control it. Suddenly he heard a voice over the inter-com phone. "I've got the cables in my hands!" It was the bombardier. "I think I can hold them," he continued.

Then began one of the most extraordinary stories of human endurance. For two hours the pilot gave verbal instructions to his crew mate who was hanging onto the controlling cables and keeping the plane on even keel. By the time the North African coast appeared, the bombardier's hands were bleeding and blistered. Once he lost his grip on the precious life-lines, but he found them again before the ship went out of control and the flight continued until the pilot was able to make a belly landing on an African beach.

Like Marauders, the Mitchells are ideal for low-flying attack, and they can look after themselves when attacked by enemy fighters. They are widely used by the Army antisubmarine patrols and have already piled up a good box score of successes against the undersea raiders.

Soon after it went into action, the Mitchell had the distinction of being the first American land-based plane to sink a Nazi submarine. A Mitchell on patrol duty a hundred miles off the Atlantic coast sighted a submarine and sank it with depth charges. A month later, two more submarines were destroyed by B-25's flown by Brazilian and United States crews off the coast of South America.

Even before the famous raid on Tokyo, the Mitchell had distinguished itself in the Pacific. On April 15, 1942, ten of these

bombers took part in the 4000-mile raid from Australia to the Philippine Islands and later returned to their base. Leader of this expedition was Brigadier General Ralph Royce. During the two days in which the planes operated over the target area, they bombed Jap airports, stores, and troop concentrations. They sank four Japanese transports, damaged a large number of other ships, shot down five enemy planes and destroyed quantities on the ground. They also rescued several persons from the beleaguered islands and returned with human cargo in place of their bomb loads.

B-25's are now operating in Russia and are playing an important part in hammering German tank concentrations. Operating from China's western Yunnan Province, Lieutenant Colonel Vincent led a flight of Mitchells against Japanese stores and brought his squadron back without loss after shooting down a number of Zeros.

One of the most thrilling adventures in which the Mitchells figured was when a group attacked a formation of huge German Junkers transport planes over the Mediterranean. The Germans were anxiously pouring troops and supplies into Tunisia, and the American and British air forces were determined to obstruct them at all costs. The Mitchells were returning from a raid on the Italian coast, when the big formation of German planes escorted by fighters hove into sight.

The American squadron leader ordered his men to the attack, and the Mitchells waded into the formation just like fighters, their guns blazing. The German planes were no match for the swift American aircraft, and five of them were shot down in flames, others limping away severely damaged. When the Mitchells broke combat and headed for home, they were attacked by more enemy planes, two of which were shot down. Later they came upon the remnants of the German transport formation and again attacked. Two Allied fighters which had joined in the fray were shot down, but all the Mitchells survived.

Reports on the battle of the Bismarck Sea, in which Allied planes sank an entire convoy of twenty-two ships heading for New Guinea, describe Mitchells as the stars of the show. They attacked in waves from ten in the morning until three in the afternoon. The B-25's were working in co-operation with Flying Fortresses, which deliberately flew high over the battleships in order to draw the Japanese fire. While the Jap gunners were firing at the B-17's, the Mitchells swooped in at masthead height and planted delayed-action

bombs on the decks of the ships. Lieutenant Robert Reed of Creston, Iowa, flew in so low that he carried away one ship's radio aerial.

During the raid, the B-25's were frequently attacked by Zeros which they knocked off without loss to themselves. When their bombs had gone, the Mitchells emptied their cannon and machine guns on the decks of the enemy ships. Later in the engagement, in company with R.A.F. Beaufighters, they destroyed all remaining small shipping in the area.

Mitchell crews in the Mediterranean had been especially trained in skip bombing, which is a modified form of dive bombing. One morning in March, 1943, a Mitchell bomber surprised an enemy troopship with two merchant vessels and destroyed them all. Said Captain Clayton Heinlin of Cleveland, Ohio: "Skip bombing works this way—you aim the first bomb at the hull of the ship, right at the water line, as you come up to the ship from the side. Then you just let a string of bombs walk right up the side of the ship and over it."

In operations against enemy shipping, the speed of the Mitchells proved to be a high safety factor. The bombers would come in fast, drop their bombs, and be out of range often before the enemy could man the ship's guns.

B-25's would seem to be the most popular medium bombers of General Chennault's air force in China. On May 8, 1943, a squadron of Mitchells took part in a raid on Canton. They were accompanied by Liberators who assisted in dropping more than 80,000 pounds of bombs on the harbor installations of this Japanese-held port and on Canton's airfields. The Japs were caught flatfooted and when finally they managed to get their fighter planes in the air, sixteen of them were rapidly shot down.

One squadron of Mitchells operating in the Australian theater of war piled up what seems to be an all-time record for long-distance reconnaissance. A report from Australia states that Dutch crews flying B-25's conducted a reconnaissance mission of over 650,000 miles—the longest single operation ever undertaken by a single group of aircraft. The flight ranged through Australia, Java, and Dutch New Guinea. On almost every day the pilots were bombing or fighting and they paid visits to sectors of the Japanese line never before visited.

The Mitchell B-25 has the distinction of being the first bomber to carry a 75-mm. gun in this war, the first plane bomber so equipped being a French Caudron in World War I. The planes fitted with this terrific fire punch have been used to sink Japanese war

vessels and supply ships in the Pacific. Future uses may be against enemy tanks, and land fortifications. The guns fire shells twenty-six inches in length weighing twenty pounds each. These projectiles will penetrate both sides of a medium tank, and if of the high-explosive shrapnel type would put an entire antiaircraft battery out of action with a direct hit.

Installing the new armament was a headache for the North American designers. It involved fitting a new and shorter nose to the bomber, the rearrangement of the pilot's compartment and controls, as well as the navigator's office, and the fitting of additional armor plate.

Special attention had to be given to the absorption of recoil. It would seem that such a heavy recoil would make the bomber literally hang in the air at the moment of discharge. Gun recoil has always been the bugbear of fighter plane design. For instance, when the eight guns of a Spitfire fighter are discharged, the machine loses considerable speed and is prone to drop its nose, for which the pilot must allow at the moment of pressing his gun teat. The recoil of the 75-mm. cannon in the B-25 is taken up by a special hydromatic spring device, which is said to be entirely successful. A pilot who has flown the machine and used the gun described the gun firing sensation as similar to the vibration of an automobile engine coughing on a cold morning.

Lengthy tests had to be undertaken before the gun was taken into the air. The engineers took an entire section of the B-25 forward of the wings and used it as a trial horse. They transported it to a range, installed the cannon, and worked for two months to get the stage of perfection needed for combat. The final installation of the cannon demanded 13,551 man hours and 380 new drawings.

The cannon itself, which is built on a mount assembly, is installed in what was formerly a passageway beneath the left side of the pilot's compartment. The muzzle projects through a tube in the lower nose section, and the breach is on the left side of the newly placed navigator's cabin. The cannon and the two .50-caliber machine guns supporting it placed in the nose above the cannon are charged and fired by the pilot. No details are available as to the rate of fire of the 75 mm., but it should be remembered that as a field gun this particular weapon has always been noted for the excellence of its performance as a rapid firer.

The gun and its ammunition added 2000 pounds to the airplane's gross loaded weight, but the North American Aviation Company

announced that the new installation has not affected the B-25's bomb-bay capacity or speed.

The first B-25 fitted with the new cannon was called *Lil' Fox*. *Lil' Fox* first fired her cannon against a Japanese air transport which was landing on the runway of an airfield. The transport disintegrated. The next target chosen was a bunch of Japanese mechanics running for shelter. "Their troubles ended right there," said a North American service representative. *Lil' Fox* then attacked the hangars, and blasted them, returning in triumph, having fired ninety rounds of cannon shells.

Her next mission was for larger game. Accompanying a B-25 mission to bomb Jap warships the new aerial destroyer slid down to attack a Japanese destroyer that was beating it for home. The gun scored five direct hits on the enemy craft, which limped away burning fiercely. The next morning *Lil' Fox* found the destroyer beached. She went into attack, her big gun thumping lustily. More direct hits, bang went the vessel's smoke stack, smash went the bridge. *Lil' Fox* turned, and went in again through a pelting fire from the vessel's antiaircraft guns. Three more shells hit, and this time one of them caused an explosion somewhere inside the vessel, which heeled over. *Lil' Fox* then went after the antiaircraft guns on the beach, and whether the shells killed the crews or they ran for shelter, the report does not say. Whatever happened the guns stopped firing. The bomber captain then decided to make a sieve of the airplane landing strip and accordingly sewed it up and down with holes, rendering it unusable. *Lil' Fox* returned to her base, with a few shrapnel holes and a bullet wound in her upper turret. Commented the North American service representative: "The plane stood up to the job very well. No structural failures occurred in or round the cannon area."

The use of the 75-mm. cannon may prove to be extremely effectual should the Germans or the Japanese succeed in getting into the air a heavily armored bomber of the Fortress type, which has constantly been threatened by Goering and expected by the Allies. The 75-mm. cannon with its reasonably high muzzle velocity is infinitely superior to the rocket gun employed by German fighters, and is considerably more accurate at greater range.

The Mitchells and Marauders are likely to be the most overworked of the medium bombers of this war because they have already proven their all-round excellence, and even if the Mitchells are not the next American bombers to visit Tokyo, there is no doubt that they will

make a reappearance over the Japanese mainland. Certainly they will fly over Berlin as our invasion forces draw near the capital. Mitchells are already in India, China, and Russia.

An international soldier of fortune and one of the most famous and "widely traveled" of American bombers is the Martin Maryland. This plane was originally designed to be a fighter-bomber and to be a companion to the machines of this type being produced in France prior to the outbreak of war.

The Maryland, built to French specifications, may be said to be the guinea pig for the design of the Baltimore, built for the British, and of the Marauder. It had the unique feature (for a bomber) of having forward-firing guns fixed in the wings and flexible guns to defend the tail. Several squadrons of the French *Armée de l'Air* were equipped with these slim-fuselaged fighter bombers, and after the fall of France a number of them passed into R.A.F. service to be flown by French pilots. When the United States Naval Air Force attacked Casablanca as a preliminary to the North African landings, large numbers of these nimble craft were destroyed on the ground.

When France fell, the R.A.F. took over the outstanding orders for Marylands, fitted their own armor and armament and operated them over Libya. During the Mediterranean operations, the Marylands flew thousands of hours. To Marylands was handed the assignment of making topmast photographs of the Italian fleet in the harbor of Taranto. Marylands also made a photographic reconnaissance of the island of Sardinia. Their speed of 294 miles per hour outflies the Italian fighters.

On one occasion, a squadron of them was attacked by twelve Italian Macchi C. 202's. After they had shot down three of the attackers, the others broke combat. "Let's chase them," said the Maryland squadron leader. The bombers set off after the fighters, caught up with them, and quickly disposed of every single one, thus eliminating an entire Italian fighter squadron, a record of which any bomber squadron could well be proud.

The Martin Baltimore, a larger, sturdier machine than the Maryland, with two 1700-hp. Wright Double Cyclones, somewhat resembles the Maryland, with the exception that it has a thicker fuselage. The Baltimore was built to British design for desert warfare, and it has endeared itself to the hearts of the R.A.F. pilots flying it in North Africa.

The Baltimore has four fixed guns in the wings, and a four-gunned power turret to defend the tail. Its first use seems to have been aiding in the defense of Malta by striking at enemy airfields and shipping. On its first sortie, a squadron of Baltimores chalked up three victories against the Italian fighters and shot down a Breda medium bomber. The British give its top speed as 320 miles per hour.

This aircraft is used for photography, submarine patrol, reconnaissance and night bombing, and has done everything asked of it with considerable reliability. Squadrons of these machines flying with Mitchells, Marauders, Bostons, Bisleys, Blenheims, and Mosquitoes, helped to maintain the round-the-clock air blitz that battered Rommel's Afrika Korps and its satellite Italian divisions to surrender.

Early in 1938, the British became aware of their desperate need for bombers and looked to the United States to make up the deficiency. The American aircraft industry in those days was making few military machines and those that were coming from the production line were needed for the Army and Navy. One commercial machine caught the British fancy, because of its speed and range. This was the Lockheed 14, then in use as an airliner. The British saw the military potentiality of the plump, stocky twin-motored greyhound of the peace skies and supplied suggestions for its military conversion. The resulting plane they called the Hudson, and from the beginning of the war this converted airliner began to pile up a reputation second to none.

The pedigree of the Hudson is as interesting as its war record. It is descended from a line of record-breaking planes which have flown round the world and conquered the Pacific and Atlantic oceans. Wiley Post made the first solo flight round the world in a Lockheed, and Amelia Earhart flew the Pacific and the Atlantic in a Lockheed Vega. Wherever planes were known, the names of the Sirrus, Vega, and Altair were known and respected.

When these distinguished American civilians arrived in Europe, the R.A.F. immediately put them to work on a variety of jobs, the most important of which was the antisubmarine patrol round the shores of England. With its long range and high speed, the Hudson was ideal for the task. R.A.F. aircrews in Hudsons were soon sinking submarines all up and down the coast.

After a few brushes with the enemy fighters and seaplanes, Hudsons proved themselves ideal as all-round bomber-fighters. Repeat-

edly attacked by Me-109 fighters and Arado seaplanes off the coast of Norway, they piled up victory after victory. They earned the name of Old Boomerang, because they always came back.

Pilots of the R.A.F. Coastal Command have a legion of almost incredible stories of Hudsons that have flown back on less than a wing and a prayer.

One Hudson that was engaged by four Messerschmitts over Stavanger in Norway returned to its English base nothing more than a flaming torch. It had flown on one engine for the greater part of the trip home, then the other engine gave out. The pilot glided down to what seemed a certain crash landing in the sea. Suddenly the engine picked up again, and the Hudson continued to fly, crabbing along with what the pilot humorously described as "a following wind." Landing on the airfield was an adventure. The undercarriage had been shot away, and only one elevator was left. As the machine touched the ground, in a belly landing, there was an explosion and a new fire broke out which finally demolished the machine, but not before the crew had got away safely.

On Coastal Command work, Hudsons have piled up an astonishing record of miles flown. Day and night since the outbreak of war, they have patrolled the North Sea and the Atlantic. During the dark days of Dunkirk, a number of them engaged in a ferry service to evacuate the British expeditionary force.

One Hudson is credited with having captured a German submarine. The aircraft was cruising on routine patrol when the pilot saw the sub's periscope. He dropped his bombs. Instead of the usual oil slick, up came the submarine itself. The German crew immediately manned their gun and opened fire on the Hudson, which went in to attack. The Hudson gunners raked the deck of the submarine with their .30 calibers. Two Germans jumped for safety into the sea; the others were killed. Then the submarine's commander appeared and displayed a white flag. The Hudson circled round and signaled that it accepted the surrender. The pilot ordered the submarine to proceed on a certain course and called a destroyer to complete the capture.

To Hudsons went the honor of being the first planes to drop bombs on Germany's Ruhr at the beginning of the R.A.F.'s effort to strike at German industry. Over Dieppe and Brest they were used as dive bombers. Over Rouen, a squadron of Hudsons executed a low-flying attack that completely put out of action a vital target

which had withstood the efforts of all night and high-level bombers.

Such versatility was hard going for the aircraft, but still the Hudson lived up to its reputation of being a "boomerang."

All kinds of jobs fell to the Hudsons on Coastal patrol. One cold winter's night in 1941, the air over the North Sea was crackling with distress signals given out by a Wellington bomber returning from a raid over Germany. The Wellington had been on fire, its radio was failing, and it could not get a "fix" from its home station. Suddenly the signals failed entirely, as a magnetic storm finished off the damaged radio and put the compass out of order. The plight of the bomber's crew was complete. The sky was overcast, making celestial navigation impossible. There was under an hour's gasoline left in the tanks.

Somewhere in England a telephone operator was busy. The bomber's headquarters had heard the SOS. They had answered, but had received no reply. The operator was flashing a message to Coastal Command. Somewhere in the North Sea was a Wellington, hopelessly lost. Coastal Command radioed to one of the Hudsons on routine patrol: "Look for a Wellington in your area." The Hudson pilot accepted the challenge and probably wondered how in blue heaven he was to spot a Wellington on a dark night, with visibility less than arm's length, as it always seems on a soupy night.

What must have seemed a miracle happened. Starboard to the Hudson appeared the dark bulk of an airplane. It was the missing Wellington. The Hudson pilot began to circle round the crippled bomber. His radio man got busy with a blinker. Back came the message, "Where are we? Show me the way to go home."

"Follow me," replied the Hudson. "What airfield would you like?"

The Wellington captain gave the information, and the Hudson laid a course, flying ahead of the bomber, keeping in constant touch with its blinker. When the bomber had been delivered to its home base, the Hudson returned to its patrol. A week later, the Hudson squadron got a note of thanks from the Wellington's crew and an invitation to come over and have a drink.

One of the most thrilling air battles in which Hudsons have taken part was an encounter between two Hudsons and a German four-engined commerce raider far out in the Atlantic with a pair of merchant ships joining in the fray. The two Hudsons were returning from convoy duty when the pilot of one spotted the German plane

sneaking up from the south under the cover of low-hanging clouds. All the pilot could see was the dim shape of wings showing gray in the mist.

He decided to follow, and signaled to his companion to do likewise. For half an hour the two Hudsons stalked the German raider, and just as they were closing in, the German ship dived through the clouds to attack two ships below. The ships' gunners put up a blaze of antiaircraft fire, some of which hit the German. The majority of fire hit the first Hudson, however, which the ships' gunners had mistaken for another enemy plane. The pilot of the second Hudson was low on gas, but he opened the throttles of his 1000-hp. Cyclones to the fullest extent and charged into the big German raider. The Hudson's fire was accurate. As the R.A.F. plane soared above the German, the tail gunner saw a body falling into the sea. They had shot one of the German crew right out of his machine.

The Hudson's tail gunner then set fire to one of the German's engines. The Germans were game fighters. The Nazi pilot turned his big machine and made for the crippled Hudson, now flying one wing down and showing signs of distress. The tail gunner was in his power turret, waiting. He opened fire with his twin guns and sewed a seam of bullets up the belly of the German plane. The fire opened the German plane's bomb bay that had not yet discharged its bombs, and as the German soared above the damaged Hudson, it began spewing its bombs willy-nilly. None of them hit the R.A.F. plane, but they came uncomfortably near. In the meantime, the second Hudson was chasing the German plane, and a battle royal ensued.

Unable to escape the faster American bomber, the German pilot put his aircraft into a tight turn and while his gunners opened fire with their 20-mm. cannon and heavy caliber machine guns, an explosive shell smashed into the nose of the Hudson, wounding the pilot. The navigator took over and flew the machine, while the pilot crawled back to work one of the side guns. For ten minutes the two machines circled round, with the damaged Hudson taking an occasional shot, and the crews of the two merchant ships crowded the decks to watch the combat.

The end came suddenly. The Hudson's tail gunner directed a burst of fire at the burning engine of the German bomber. He swept his gun inward and hit the other engine. There was an explosion and the huge four-engined German, probably a Fock-Wulf Kurier, heeled over and slipped vertically on one wing into the sea.

"Thank you," said the pilot of the crippled Hudson to his wing-

mate. "I'm going to land beside that little boat. My petrol is out." The victorious Hudson set off for home, but like its companion, it was forced to land in the sea—a few miles from land. The R.A.F. rescue service dispatched a boat to pick up the crew, and a lighter was sent to salvage the aircraft. According to legend, this particular boomerang was in the air soon afterwards, but that may be just legend.

The R.A.F. faith in the Old Boomerang is such that they will shoot a line about this American-built plane in preference to singing the praises of their own bombers. One Hudson taking part in a raid over Brest was severely damaged by antiaircraft fire. The fuselage caught fire, the landing gear was shot away, and there were about three feet of wing missing on the starboard side. The pilot spoke to his four companions. "Chaps, you know what they say about this machine . . . it always gets home."

"The Boomerang is short a tail, Captain," reported the rear gunner. "But we'll get home."

"That's what I was thinking,'" added the navigator. "We'll get home all right."

The radio operator was sitting near a huge gash in the fuselage made by a shell splinter. "Nice breeze tonight," he commented. "Quite wakes a fellow up."

"I'll bet a dollar we make it," said the pilot grimly, heading for home. As he spoke, the port engine cut out. "I'll raise it to two dollars," he said.

"I'll make it three," called the rear gunner. "I've always believed in tailless airplanes."

Joking and bantering, they made for home. Halfway over the Channel, German night fighters took a pot shot at them. The bullets streamed past the tail. "If we'd had a tail," laughed the rear gunner later, "he'd have hit us."

The German fighter turned to follow the Hudson home, a favorite ruse of night fighters on both sides. The Hudson's gunner waited until he was almost within what he called "arm's length," and opened fire. The German disappeared with a splutter of sparks. The Hudson toiled on. Finally the welcome coast of England appeared. Without any undercarriage or tail, landing was impossible. The pilot headed the machine toward the sea, plugged in "George," the automatic pilot, and told the crew to bail out. This is how he describes the end of his adventure.

"You couldn't see anything but whiteness about because we were

still in thick clouds. With my rip cord in one hand and cap in the other, I jumped. I don't remember pulling the rip cord, but I suddenly found it loose and I was swinging gently from side to side in the clouds. It was the most marvelous sensation—so peaceful and quiet after all the racket in the aircraft. I had no sensation at all of falling—only of moving gently about in the air, with a soft breeze brushing my face.

"It was a tremendous relief to see the aircraft disappear into the clouds about a hundred yards away. I thought the others would be somewhere around so I gave a shout, but no one answered. Then I looked up at the parachute. It seemed very small. I stuck the rip cord in my pocket—they like you to bring these back—tucked my cap safely in under my harness and went on floating through the air.

"Suddenly just below me I saw a surface with a long white line running across it. For a split second I thought it was the sea. Then I realized it was a stone wall. The next moment I had bumped on the ground. I don't think I ever enjoyed a bump so much."

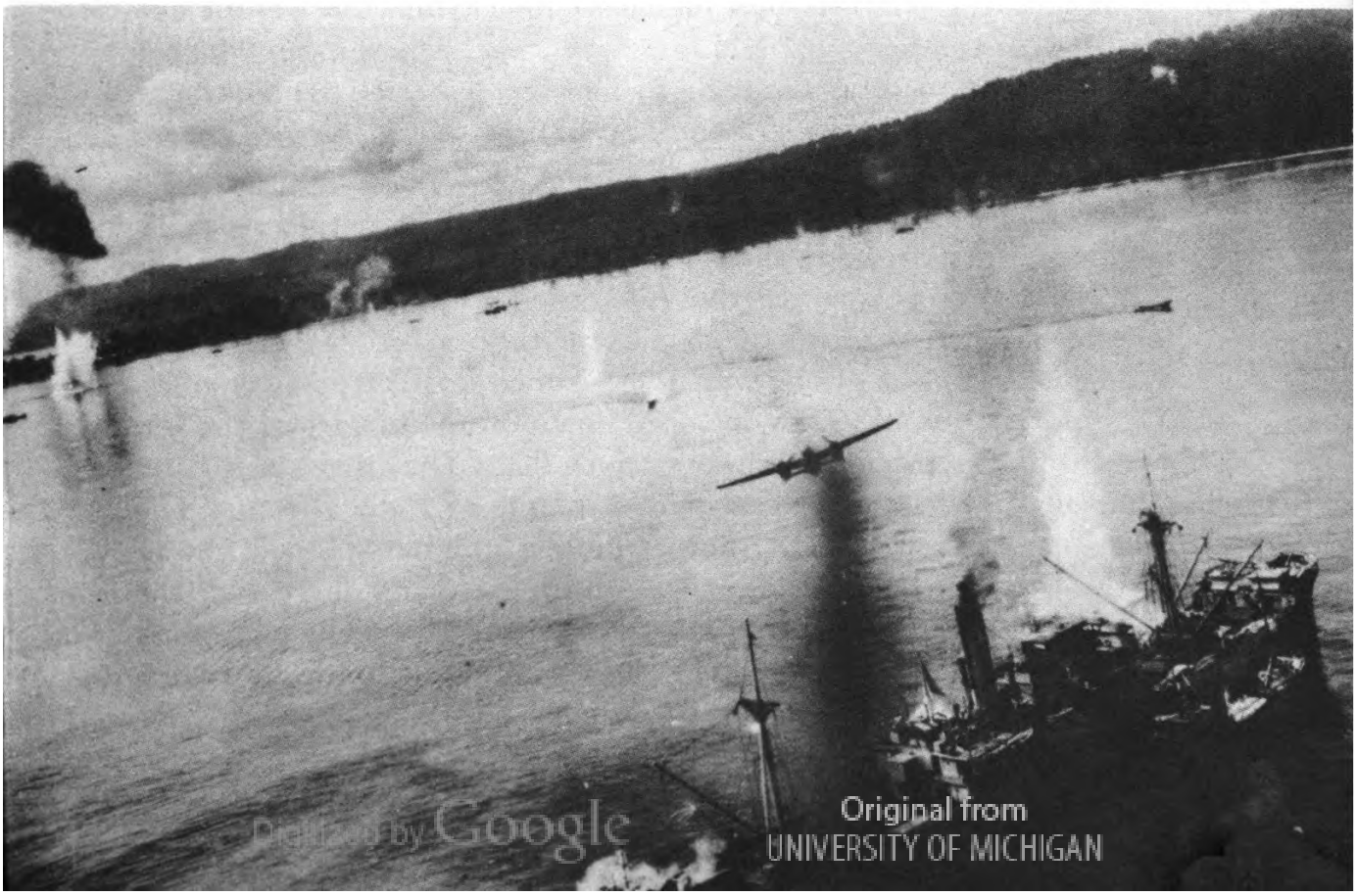
Said the rear gunner, "It broke my heart to think of our old Boomerang flying out to sea without us. I wouldn't have been a bit surprised if she had turned up on the tarmack at breakfast next morning—but she never did."

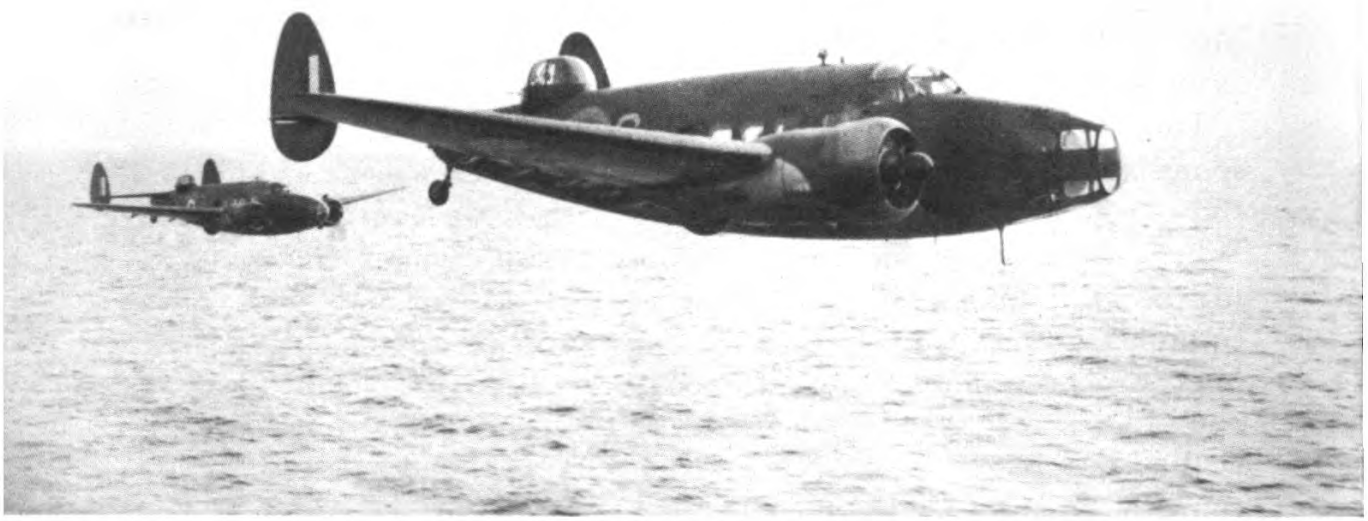
How many submarines have been sunk by Hudsons of the Coastal patrol will not be revealed until after the war, but the score is steadily mounting.

Crossing the Atlantic in a merchant liner, I had the unique experience of seeing a pair of Hudsons at work. The ship on which I was traveling was fast enough to look after herself, and after a preliminary brush with German aerial commerce raiders, which were beaten off, the convoy scattered and we headed for mid-Atlantic at full speed. Occasionally one of the Hudsons would fly past us, while the other circled in the distance.

While the crew manned the guns, those of us allocated as submarine watchers scanned the surface of the sea for the sea raiders. Suddenly from out of the west there came a roar of plane engines. Two more Hudsons! They swooped down on the surface of the sea. One dropped something. It was a smoke float. The other circled and climbed, and then seemed to dive. A plume of water shot up. The other plane followed suit. Another plume, and an explosion. Away to the right, another Hudson was nosing here and there over the surface of the sea, rather like a terrier hunting a rat. The pilot must have signaled to the original Hudson which had been our escort,

Raid on Wewak harbor. Above, a Mitchell has just dropped its bomb load on a Jap freighter; while, below, another Mitchell is making an approach prior to releasing its bombs on a second freighter that has already been the target of American bombs. In the distance, another Mitchell can be seen approaching. *U. S. Army Air Forces.*





(Above) Lockheed Hudsons of the R.A.F. Coastal Command on action patrol, flying only fifty feet above the sea in the Heligoland Bight area. *British Official Photograph.*
(Below) The wireless operator of a Coastal Command Hudson on Atlantic convoy duty wards off drowsiness with hot coffee. *British Official Photograph.*

because it left its position ahead of us and hared off to join its mate. Another smoke float. Three more depth charges. Our ship then changed course violently and with engines at full speed churned its way out of the danger area.

Later one of our protectors flew over us at masthead height and the rear gunner waved his hand through the open window of his turret. Said the ship's second officer whose watch position I was sharing: "If those fellows could come with us all the way, we'd be as safe as on dry land!"

During their Atlantic patrols the Hudson crews have been responsible for the rescue of many passengers and crews of torpedoed ships, who have been adrift for days with little hope of rescue. Whenever news of a ship being torpedoed within reach of land comes in, the Hudsons go out to scan the ocean for survivors. They are equipped with emergency kits of food, water, and medical supplies, which are immediately dropped near the boats.

Coastal patrol involves encounter with enemy surface vessels as well as aircraft. The R.A.F. Coastal Command Hudsons have become the terror of the coastal convoys which the Germans from time to time endeavor to slip along from Norway to occupied Europe. Whether the convoys go by day or by night, the Hudsons have harried them without let-up. Three Hudsons surprised a convoy of eight ships escorted by destroyers, and left four of them burning. Another Hudson attacked a German flak ship being towed into position off the coast of Norway and dropped a heavy bomb amidships. "It was quite a fireworks display," wrote the Hudson captain in his combat report.

If for nothing else, the Hudsons will be remembered by the British for their part in sending to the bottom the German battleship *Bismarck*. One morning in May, 1941, a Hudson squadron was on patrol in the North Sea. Through a gap in the clouds, the navigator of one saw two unfamiliar battleships in the Bergen harbor. That afternoon a photographic plane was dispatched and the results showed that the two vessels were the *Bismarck* and the *Prinz Eugen*, which were then popularly supposed to be safe in the Kiel Canal. Next morning the Hudsons returned. The huge ships had put to sea, and immediately the Royal Navy set out to look for them, knowing well that they were headed for the North Atlantic convoy route.

The Hudson is perhaps the best known of all American planes to the British public, perhaps because it was the first to be ferried across the Atlantic, perhaps because the British gave it more publicity than

any of the other Yanks in R.A.F. uniform. With its reputation for safety, reliability, speed, and ability to fight as well as bomb, the Hudson was given the honor of becoming the personal plane of King George of England. Fitted with special armor and armament, a Hudson is always available to take the monarch on his war trips.

There are probably more Hudsons in use by the British than any other American plane, and certainly no plane in the R.A.F. has undertaken so many diverse jobs. When Hudsons were included in the first thousand-plane raid on Essen, the British public accepted it as a matter-of-fact action, and one newspaper went so far as to exclaim that a thousand Hudsons would win the war. Some of the missions on which Hudsons have been dispatched are still very secret and cannot even be mentioned.

How high is the R.A.F. opinion of this converted airliner is shown by the fact that Hudsons are operating in Australia with the Royal Australian Air Force, in Burma, and in North Africa, as well as on the European front.

With such a dazzling war record in Europe, the Hudson was destined to be drafted for the United States Army and Navy. The American public first learned of the Hudson's American success when in January, 1942, Ensign Donald Mason sent the laconic message from his patrol bomber, "Sighted sub. Sank same." Others followed, and the Hudsons soon helped drive the U-boat away from American coastal waters.

The R.A.F. showed its appreciation of the qualities of the Hudson by clamoring for more planes of the Lockheed breed. They especially wanted a bigger version that could carry more armor and more bombs. In the Lockheed stable was ideal material, a larger version of the Lockheed 14, known as the Lodestar, fitted with two 2000-hp. engines and designed for transport purposes. The R.A.F. had modifications to suggest, such as the fitting of additional guns, an improvement in fuselage design, and rearrangement of the interior.

The new machine, which the United States Army calls the B-34, proved to be an outstanding success. Carrying its bigger bomb load, and packing a fire power proportionately heavier than any bomber of its weight, the Ventura has already been employed on daylight raids over occupied Europe and has struck heavy blows at enemy shipping in the Mediterranean. The United States Army version is said to carry .50-caliber guns in five different positions, and it carries a crew of five.

The Ventura's top speed is said to be in excess of that of the Hudson, but it has the remarkable quality of being able to land at under 80 miles per hour. Carrying a load which is probably 50 per cent greater than its smaller brother, its range is considerably greater. A recent statement issued by the makers inferred that by using detachable gas tanks that can be jettisoned when empty its range exceeds that of any other high-speed plane.

The Hudson and Ventura both have the egg-shaped twin tail fins and rudders and sharply tapered wings, with the same plump teardrop fuselages.

All things considered, its speed, load capacity, and ability to take off and get down in small areas, may destine the Ventura to play a very important part in subsequent events in the Pacific. It would be a useful plane for the Russians to use in defense of Vladivostok, it would be invaluable in China, and it might well be the plane chosen to follow the Mitchells over Tokyo, especially as its heavy fire power makes it more than capable of defending itself.

These medium bombers have played and will continue to play a great part in the ultimate victory we expect to come through our combined air, land, and sea power. In a cable from London, Peter Masefield, an aircraft designer turned writer and radio commentator, summed up: "One of the most useful types of American aircraft is the medium bomber, the Hudson, the Maryland, and Baltimore, the Mitchell, and the Marauder. They have flown tens of thousands of hours and millions of miles over the sea and over enemy territory, and have dropped thousands of bombs which have caused immense destruction . . . these medium bombers are the most formidable weapons coming from America, and there is nothing 'medium' about their punch." With which I heartily agree.

Chapter Eight

BRITISH MEDIUM BOMBERS

WHEN the war broke out, the British were caught short on mediums, and on attack and dive bombers. The Handley-Page Hampden was becoming obsolescent, but was pressed into service as a night bomber, and the role of medium bomber was passed on to the Bristol Blenheim, which was in reality a light bomber and fighter-bomber.

From medium bombing, the Blenheim passed to long range, fighting, dive bombing, night interceptor work, night bombing, mine laying, photography, and practically every other task that could be given to an airplane.

Its ability to fulfill these multiple roles is a tribute to its ancestry, for it is a direct descendant of the famous Bristol Fighter, the most efficient fighter-bomber of World War I, and probably the machine with the longest service life of any warplane. The Bristol Fighter made its debut in France in 1917, as a day bomber. It finished the war carrying mails, food, and brass-hats, to continue as a bomber in the Middle East and India, and was still flying ten years after the close of hostilities, surely an all-time record for durability.

The Blenheim indirectly owes its development into a warplane to an American Lockheed airliner, forerunner of the Hudson. In 1935, Captain Frank Barnwell, designer of the Bristol Fighter, the Bristol Bullet, and other successful warplanes, turned his attention to commercial aircraft. To the 1935 Paris Aero Show he sent an all-metal twin-engined airliner. With the exception of a few newspapers, no one took very much notice of the new machine. German and French technical magazines published reports, but there were no bids from British airline operators for the metal plane, although it showed distinct potentialities regarding speed and general performance.

About this time Lord Beaverbrook, proprietor of the London *Daily Express,* and later Britain's Minister of Aircraft Production, became extremely air-minded. He had bought a Lockheed plane to enable him to visit the French Riviera and North Africa to get

relief from his asthma. Being a newspaper man, he gave considerable publicity to his new toy.

Lord Beaverbrook's bitter rival in newspapers was Lord Rothermere. He had been England's Air Minister during World War I and inherited the *Daily Mail* from his brother, Lord Northcliffe. Not to be outdone by his rival, Lord Rothermere set about looking for an all-British product to equal that of his Canadian-born rival. He found it in Frank Barnwell's twin-engined "convertible airliner." Rothermere bought the machine, and when it proved faster than anything in the air, he called it "Britain First" and offered to present it to the British Air Ministry. By one of those miracles that can happen in a democratic England, in spite of red tape and political prejudice, the Air Ministry accepted the plane.

Once the plane had been accepted, Rothermere and his energetic writers determined that the Air Ministry should not forget it. Soon it was announced that a new version of the "Britain First" was being manufactured as a bomber. It was named the Blenheim.

Five different types of the Blenheim have been manufactured since the first machine made its appearance, the latest, the Blenheim V, being called the Bisley, an attack bomber which operated with considerable effect in Marshall Tedder's day and night assault against Rommel in North Africa.

The first Blenheim had two radial Bristol Mercury engines each with 920 hp. It had a span of 56 feet, 5 inches, was 42 feet long, and had a wing area of 469 square feet. The plane weighed 8100 pounds empty and carried 4400 pounds' load, including 300 gallons of gasoline. With a range of 1900 miles, the Blenheim was exceedingly fast, as machines went then, being capable of 295 miles per hour at 20,000 feet.

Barnwell, who himself had actual experience as a pilot in World War I, intended his bomber to be self-defended. He fitted gun turrets and armor. Few people could have imagined at the time just what these Blenheims were going to be called upon to do, or that the design would develop into two of the most outstanding machines the R.A.F. has ever put into the air—the Beaufort torpedo plane, and the deadly Beaufighter.

Blenheims had the distinction of taking part in the first British raid of the war, when a mixed squadron of Blenheims and Wellingtons left England on September 3, 1939, to bomb the Kiel Canal. The pilots were met by heavy antiaircraft fire, and although they

executed what in those days seemed to be a heavy bombing attack, the results were never made public. Five of the aircraft were reported missing. The losses were caused by antiaircraft fire, and not by German fighters, so military observers at the time were not fully convinced that it was necessary to give fighter protection to day bombers, a theory which was later to prove costly.

When the Germans invaded Norway, the British had no fighter planes capable of flying from British bases to operate over the irregular coast of the invaded country. Someone had the bright idea of increasing the armament of the Blenheims and reducing their bomb load. Several squadrons of Blenheims were fitted with extra machine guns and sent into action. With their speed of better than 300 miles per hour and extreme maneuverability, they soon proved themselves formidable long-range fighters. They not only took on the German Me-109's, but they ground-strafed the airfields that the Germans had taken over and bombed the frozen lakes on which the German Stukas were landing. One squadron of Blenheims made repeated attacks on a German airfield and succeeded in putting it out of action, destroying all the German bombers which had landed there.

This success of the Blenheims focused attention on their possibilities as all-rounders, and the British with their facility for improvisation applied themselves to the task of further increasing the armament of the machines.

When the Battle of France became a rout, squadrons of Blenheims with the R.A.F.'s advance striking force not only acted as medium bombers, but also undertook many low-flying missions. Additional guns had been fitted beneath the fuselage, and the aircraft dealt out severe punishment to the Luftwaffe, especially since their long range and weight-carrying capacity enabled them to carry more ammunition than the Spitfires and Hurricanes.

Blenheims seemed to be everywhere during those dreadful days, and many scenes of heroism were enacted in the cockpits of these tough machines. One of the most heroic episodes in their battle history was the attack on the Maastricht Bridge across the Albert Canal in Belgium, when the Germans were crossing the Meuse.

The Germans were pouring troops across the bridge and a squadron of Blenheims was sent out to destroy it. Theirs was a suicide assignment, as the careful pre-invasion plans of the enemy had provided for a large formation of antiaircraft batteries to cover the bridges and had also moved up a wing of fighter squadrons.

The Blenheims reached the bridge and began to drop their bombs. In the middle of the operation, they were attacked by a squadron of Me-109's. As the Germans attacked what they must have considered "sitting birds," the squadron leader of the Blenheims observed that the bridge had received a direct hit and would be out of action for the rest of the day at least. He gave his pilots the order to rally in formation, and the Blenheims sailed into the Messerschmitts. The British gunners delivered such a well-directed fire that the German formation broke up with what appeared to be many casualties.

The Blenheims flew back to their base. Some of the aircrews had been killed, some wounded, and every plane had been damaged, but their objective had been achieved and the Luftwaffe pilots taught to respect the "slow" British bombers.

Twelve Blenheims were later dispatched from a British base to attack a German tank column threatening to widen the gap already made in the French lines. The planes flew in formation, but before they reached their target, they were separated by intense antiaircraft fire. They were then attacked by German fighters. They fought off the fighters, reached their target and finally dropped their bombs, but only one of them returned.

One night during the Battle of France, when it was imperative that Calais be defended at all costs, a Blenheim squadron stationed in the south of England was pressed into service to carry water and ammunition to the citadel of the French coastal city being defended by British marines and soldiers. The planes loaded up with containers of water in place of bombs, each carrying ten gallons attached to a parachute. The squadron set out just before dawn, flew through German fighters and antiaircraft fire, and dropped their loads from about fifty feet. They made two sorties. One of the Blenheims took time out after unloading the water and small ammunition to shoot down two Stuka dive bombers which were attacking the citadel.

When the Germans won the battle for Greece and launched their invasion against Crete, Blenheims again were the only aircraft with sufficient range to carry a load of bombs to the Greek mainland from British Mediterranean bases. One squadron of Blenheims made a devastating raid on German troop concentrations and airfields in Greece. They dropped their bombs and the pilots returned to carry out a succession of machine-gun attacks on enemy transport planes, gliders, and bombers. So successful was this operation, that the actual invasion of Crete was considerably delayed.

To Blenheims fell the honor of opening the R.A.F.'s campaign

against Occupied Europe, with a sortie against German airfields at Dieppe and Calais during January, 1941. On this occasion, all the Blenheims returned safely, and one gunner was credited with having shot down a German fighter.

Again the Blenheims had acquired a reputation to which they were not really entitled, and again this remarkable bomber was dispatched on a comparatively long-range bombing expedition, unescorted. This time the squadron was intercepted by a strong formation of German fighters, and a large number of planes were lost. It was then decided that the Blenheim, which was comparatively slow beside the modern fighter, should be used for medium night bombing with escort, or for daylight attack bombing, also escorted.

As a night bomber, the Blenheim proved itself well suited for its task. Squadrons of Blenheims raided the Ruhr, Holland, and the French coast. Their pilots brought back many stories of encounters with German night fighters. One rear gunner related how he had spotted a Dornier flying in the R.A.F. formation returning from the Ruhr, with the intention of discovering their airfield and blasting the machines as they came down to land. He warned his pilot that there was a stranger in their midst. The pilot reduced his speed and when the Dornier was almost colliding with the Blenheim, the rear gunner opened fire and blasted the audacious German out of the sky.

Blenheim pilots seemed to be imbued by the pugnacious attributes of their machine and liked nothing more than to go looking for trouble after they had dropped their bombs. One pilot returning from a raid on Cologne spotted an enemy airfield 8000 feet below him, near the French coast. He had no bombs, but decided to go down to strafe it. He dived, and suddenly the bright moonlight revealed he was between two German Junkers 87's, patrolling over the airfield.

He did the only thing possible, attacking them both while still in his dive. Both German planes burst into flames and went down. As he pulled out of his dive and found himself just 200 feet above the airfield, there in front of him was an Me-110, about to land. He used his remaining ammunition on this and watched it crash on the flare path. Then he made for home. For his extemporaneous action, he was awarded the DFC.

Blenheims are high in the lists of machines that get home after suffering severe damage. One R.A.F. wing commander who had been leading a squadron attacking an enemy airfield in March, 1941, was severely shot up by antiaircraft fire as he dropped his bombs. He

decided to make one last run to machine gun the hangars, when a small caliber antiaircraft shell burst near his cabin and wounded him.

The machine itself was in bad shape. Part of the port wing had been shot away, and the stabilizer was damaged. The navigator looked back and saw that the top of the fin was missing. Add to this the bad news that the port engine was smoking as if ready to break into flames at any moment, and you can imagine the pilot felt he had little chance of getting home.

He decided to try, and he headed the crippled Blenheim toward the coast. Another antiaircraft shell burst near the plane and damaged the starboard aileron. The shock of this explosion, plus the pain he was already suffering, caused the pilot to lose consciousness for some time.

He came to, to find the machine still flying, although it had deviated from the course. To his astonishment, the engine had stopped smoking and picked up its revolutions. He asked for a radio fix, and found his airfield. Then he found the undercarriage release gear was hopelessly smashed and he had to make a belly landing, which was somehow accomplished without further damage.

The pilot was taken to the hospital, and the R.A.F. repair crew gathered to compute the damage done to the hardy bomber. They agreed further inspection was useless, for by all rules the Blenheim should never have covered the two hundred miles back to its airfield. It was, to use the term of one of the squadron, "just a mess."

Blenheims featured largely in the combined operations raid on Dieppe, while Spitfires and Hurricanes provided a protecting umbrella. Squadrons of Blenheims and American Bostons roared down to attack the ground targets and to lay smoke screens. How successful were the bombers on this occasion is shown by the fact that out of ninety-eight British machines lost, only three were bombers.

The Blenheim is still in operation as a medium bomber and fighter-bomber on various battlefronts. Some of its work has been taken over by the Douglas Bostons and Havocs, but it is still fighting valiantly and is in mass production in England.

The Blenheim's predecessor, and unhappily for its pilots its companion in the early conception of medium bombing, was the Fairey Battle, built by the Fairey Aviation Company which specializes in producing planes for Britain's Fleet Air Arm.

The Battles were produced in 1932 and followed closely on the lines of a previous experimental single-engined bomber that had been fitted with an engine reputed to have greater horsepower than anything previously taken to the air. Neither the engine nor the

airplane were put into production at the time, but the design had pleased the men in power at the Air Ministry and later the Battle was produced in large numbers, without much consideration being given to the use for which it was most fitted. It was an all-metal, but lightly armored, machine, with a Rolls-Royce Merlin and armed with two forward-firing guns and a .30-caliber Vickers gun in the rear cockpit.

The original conception of the Battle was that it should be used for medium daylight bombing attacks, with fighter escort, much as the De Havilland 9a was employed in the last war. When it became evident that the Luftwaffe was equipped with large numbers of dive bombers, the British decided that the unhappy Battles should be employed as the British equivalent to the Stuka.

The men who flew the Battles must have known their mounts were entirely unsuitable for this kind of work, especially as their losses in night bombing were extremely high, so high in fact that they were switched back to day bombing as losses went even higher.

This should have been taken as a warning that there was something wrong with the machine. Its superlative defect was age. It belonged to the World War I conception of a bomber, and it should have been respected as such, and discarded.

In the middle of the Battle of France, when German Panzer units were roaring westward, Battles were called upon to execute missions that in the light of history can only be compared to the foolhardy episode of the *Charge of the Light Brigade* at Balaclava, of which the poet wrote, "Someone had blundered."

The fields of France became strewn with shattered Battles. During the R.A.F. assault on German troops advancing across the Meuse, half the Battles sent out in one day were destroyed by German fighters and antiaircraft fire.

On May twelfth, when the combined attacks of Blenheims and Hampdens had failed to destroy the vital bridges across the Albert Canal, one squadron of Battles was called up to undertake the job. Every flying member volunteered. The final selection was made by drawing lots, and the machines set out to fly through a wall of antiaircraft fire.

Only one machine came back—and that crashed in flames inside the Allied lines. One of the Battles had accomplished the mission by crashing on the bridge. The pilot, Flying Officer Garland, and Sergeant Gray, his gunner, were awarded VC's for their part in the raid from which they did not return.

Two days later the Battles were out again on a similar mission. By a miracle all returned, although several of the crew were wounded. Later in the day four other bridges were scheduled for destruction. Out of sixty-five Battles used in the attack, only thirty-five returned, probably the heaviest R.A.F. casualty list by percentage of the present war.

The Squadron concerned was No. 12, which was one of thirty R.A.F. squadrons to be awarded the Royal Standard by King George VI as an appreciation of its twenty-five years of service, and distinguished war record. The standards will not be made until after the war, but their presentation raises the status of an airplane squadron to that of an infantry regiment which has its colors handed down from generation to generation. No. 12 Squadron R.A.F. chose the emblem of a Fox as its squadron insignia, being the only R.A.F. Squadron equipped with Fairey Fox machines. Its motto is "Leads the Field."

When it was withdrawn from active service the Battle became a pilot trainer.

Chapter Nine

THE BOSTON

THEIR bitter experience with the Battles made the British look to America for replacements, and they found exactly what they were looking for in the A-20, the Douglas attack bomber being built at the time by the producers of the famous Douglas airliners. The French had wanted fighter-bombers, and this comparatively light twin-engined bomber for a crew of three seemed ideal for their purpose. The original A-20's were fitted with two 1600-hp. air-cooled Wright Cyclones and were capable of a speed that topped 300 miles per hour with a full load.

The British eagerly took over the existing supply of these speedy bombers after the fall of France and used some of them as night

fighters and intruder bombers. Its long range and astonishing speed made the A-20 ideal for night defensive work. Fitted with cannon and machine guns and with the British electrical night-interception device, the black-painted Havocs cruised around the British capital and along the coastline, ready to pounce on any German night raiders. Sometimes they followed the bombers to their home stations and shot them down as they glided onto the flare path.

Whatever they did, they did well. The truth is that the A-20 not only did all that was asked of it, but it did a great deal more. At the time the Havocs first went into action, one heard fabulous stories by R.A.F. pilots who were flying, or wanted to fly, the little bombers. One pilot destroyed three German bombers in a single moonlight night during the heavy attacks on Britain. Another on intruder operations shot up a German airfield and collided with an overhead cable. He flew back to his base with the cable twined round his wing, while dangling below was the top of the pole to which the cable had been attached.

When the British began to hit back by daylight against the Nazi barge and troop concentrations threatening invasion, the Bostons were the spearhead of the raids. Flying at 500 feet or less, they swept across the Channel at 300 miles per hour or more and often dropped their bombs before the German defenses were aware of their presence.

For daylight work, the Bostons were fitted with four machine guns in the nose and two in the rear cockpit. The crew of three sit tandem fashion with the bombardier in the glass nose, the pilot on a higher elevation behind him and the gunner-radio operator in the rear. Owing to the narrowness of the fuselage, the crew cannot change places in mid-air, so in case of injury to the pilot, the rear gunner has a complete set of duplicate controls to enable him to take over. It seems as if he would have a very difficult task flying the machine from this position. For night flying, the bombardier is replaced by a gunner-navigator, who is also responsible for the functioning of the radio-locator carried in the nose, from which protrudes a metal antenna.

The British could not get enough Bostons for the work they had in mind, and the British Purchasing Commission in Washington was at pains to expedite the delivery of the nimble ships. With the Beaufighter coming into service as a night fighter, it was possible to withdraw the night-flying Havocs and use them to replace the Blenheims on daylight raids.

Many of the aircraft arriving from America were dispatched to the African front. In England and in Canada, new daylight attack-bombing squadrons went into training. Soon stories began to filter through the censorship of encounters between Bostons and German fighters. One section of R.A.F. Bostons were pounced upon by a squadron of Me-109's. The Boston gunners shot down three of their attackers and flew over their target in formation.

As they released their bombs, one of the Bostons received a direct hit from a small caliber antiaircraft gun. "I saw the hole appear in the port wing," reported the pilot. "Of course I expected all kinds of things to happen, but the machine just bumped two or three times as if it were running over a rough landing ground, and then it behaved perfectly normal. The next thing I remember was a shell bursting smack over the cockpit. A splinter crashed through and hit me on the shoulder. I believe I passed out, but when I came to, we were still more or less in formation. On our way home three more Jerries came down to beat us up. My rear gunner shot down one, and from then on it was plain sailing. My landing was a bit unorthodox because the undercarriage was out of action. We finished up with our nose in a hedge, but none of us were hurt."

When the United States Army Air Forces arrived in England, they found that the only American machine over which the British were whole-heartedly enthusiastic, without any modifications of their own, was the A-20. But, if one reads between the lines correctly, there were no A-20's for Americans to use, and the United States fliers had to sit by and watch the R.A.F. achieving miracles with their nimble little bombers.

July 4, 1942, must have seemed an appropriate date for the American fliers to hand some explosive calling cards to the Nazis, and so "something" was arranged.

The R.A.F. Bomber Command went into a huddle with the Yanks, and early that morning twelve Bostons darted into the misty summer skies. Six of them carried the insignia of the U.S.A.A.F., and the other six the circular insignia of the R.A.F. They flew in formation without fighter escort, so low that their bellies almost scraped the calm waters of the English Channel. Their course was SSE. It brought them over the coast of Holland at the Hague, former seat of the famous International Court and venue of the Hague Convention.

The German antiaircraft gunners were waiting. Into the sky they blazed a curtain of shrapnel and high explosives that in the words

of one of the R.A.F. pilots "looked as if the whole sky ahead of us was exploding—the heaviest barrage I ever saw."

The leader of the squadron knew a thing or two. He zoomed upward. The squadron followed, twelve darting arrows heading skyward. They leaped right over the wall of destruction and dived down on the other side, to skim the streets of the old city at rooftop height. Ahead was their objective, the DeKooy airfield where German bombers and fighter squadrons, and the greater part of the Luftwaffe personnel in the Netherlands, were housed. The target was a tough nut for a daylight raid. Round the entire border of the field the Germans had erected flak towers mounting light, medium, and large antiaircraft guns. From gunpits set in the actual airfield, heavy caliber machine guns began to blaze. From an adjoining field, converted antitank rifles were carefully placed to deal with just such an attack.

The arrival of the roaring Bostons was the signal for the Germans to throw up everything they had. The sky over the airfield turned a dirty gray, dappled with black and white plumes as the shells exploded. From the ground streaked golden lines of tracer and incendiary bullets.

Down flew the Bostons. Crump! Crump! Crump! The bomb aimers opened their bomb bays and trains of bombs crashed across the hangars, barracks, and runways. One train ripped through a hangar and a huge flower of debris blossomed into the sky. Their bombs dropped, the Bostons turned and swooped in again, this time with their machine guns blazing. One plane flew across the field, ten feet above the ground, firing into the mouth of the main hangar, while others swooped and weaved to attack the German gun positions. Another blasted a radio mast. To quote the R.A.F. pilot: "We certainly got in the hair of those Huns. Some of the gunners were knocked out, and I saw some of them diving into trenches."

From adjacent airfields roared squadrons of FW-190's, Germany's crack fighters. One of them flew in to attack. A direct hit from his own antiaircraft sent him crashing to the ground. The Bostons finished their work of destruction and then rallied for the return journey. They had taken punishment, but all were airworthy.

Captain Charles Kegelman, pilot of one of the bombers bearing the American insignia, ran into plenty of trouble. As he dived onto an enemy gun position, a direct hit from a medium antiaircraft shell shot away his starboard propeller. Another set fire to his engine.

Momentarily out of control, the Boston side-slipped to the ground and bumped the bottom of its fuselage. For what must have seemed an eternity to Kegelman and his crew, the machine careened along the ground, dragging its right wing tip. Suddenly it lifted and began to fly again, its remaining engine driving it forward at high speed. Kegelman's blood was up. Once he had control of the machine, he was determined to sell his life and those of his crew at high cost to the Germans.

Ahead was a flak tower. The pilot's aim was true. A burst of fire from the Boston's nose guns silenced the German guns and left the gunners dropped round their weapons. Then the gallant flier headed for home in his crippled plane.

In the meantime, the Focke-Wulfs had got on the tails of the departing Bostons, but their chase was short in duration. Rear gunners put up an effective cross fire, and the Germans soon gave up the chase. Kegelman's bomber looked like a sieve when it finally landed on its home airfield, with more than a hundred holes in the wings and fuselage. As a token raid, the sortie had been an outstanding success, and it showed the American pilots that the A-20 was as good a machine as the R.A.F. cracked it up to be.

The R.A.F. also made good use of their Bostons in North Africa. These were later joined by American Boston squadrons. Working with Marylands, Baltimores, and Blenheims, the Bostons attacked Rommel's communications and airfields by day and night. Sometimes they were used for medium bombing, and on other sorties they flew low, dropping parachute bombs.

From Egypt I received a priceless British communique detailing the work of the Bostons undertaking what Air Chief Marshal Tedder delighted in calling "Boston Tea Parties." The phraseology is delightfully "British official," but it serves to give an idea of the damage inflicted by the Bostons on Rommel's armies and air forces.

"Boston tea party bombing," says the account, "is associated, like all successful tea parties, with effective methods of service, and with the Eighth Army, the tea parties have been signally efficient.

"The exposition of the ingenious system on which tea party bombing is based shows that its keynote is bombing to a predetermined pattern. This has a quality of mathematical certainty when time and chance combine, which creates a high degree of uncertainty among those at whom the bombs are aimed. They keep asking themselves, 'Where will that one go?'

"For instance, Tedder pointed out that one can see where a Stuka

is aiming its bombs and need not be afraid if one is not within its immediate sphere of influence. But with the air fleet dropping bombs in a premeditated mosaic of murder in accordance with the latest pattern, chances of survival, except in a bombproof shelter, are exiguous.

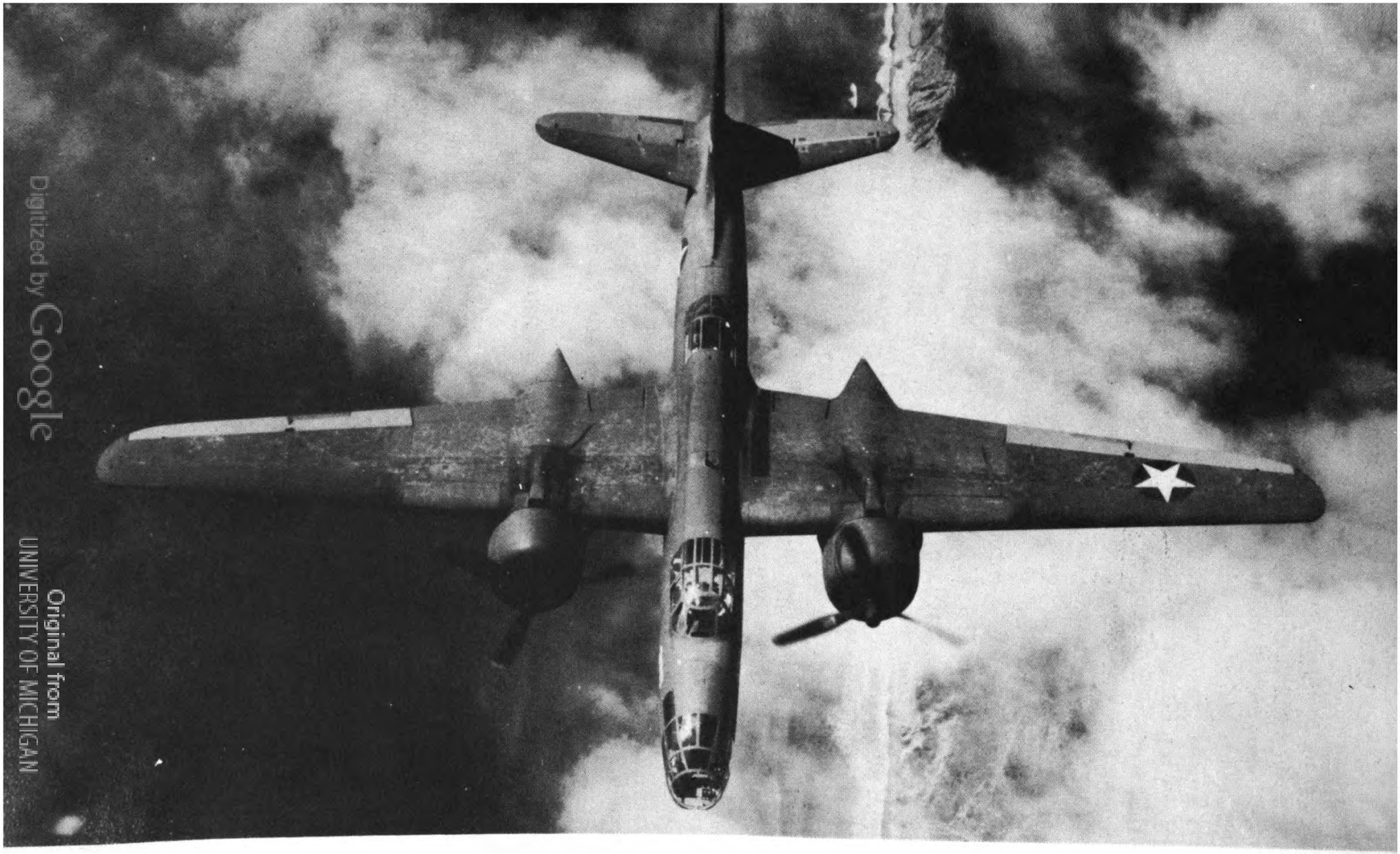
"When Bostons and Baltimores are weaving their carpet of death, they work to a design ensuring that the blasts of bombs will overlap and do the greatest harm to the greatest number. Matters are so arranged that fifteen yards is the maximum distance between explosion and explosion, by which anyone in the area so treated, even if he is not directly hit, will be within effective blast range of four explosives, one at each corner of a patterned square which hems him in. The method of sewing an area with death is perfectly simple. Bomb-dropping machines fly in formation in horizontal straight lines, each from one to two hundred yards behind its predecessor, and at a signal all bombs are simultaneously released. The result is a Boston tea party.

"It is obvious, however, that the methods must be related to the task in hand, and that tea party methods might not be feasible in the face of strong enemy interference which would upset the formation of those about to set the table. Given suitable conditions, valuable results are achievable. These have been attained *in excelsis* when a muddy airfield has grounded enemy planes or when these have been driven down by aerial combat and are trying to get a second wind. Where pattern-bombing has been operated at will, one hundred damaged aircraft have been subsequently found on an aerodrome which fell into British hands."

The pilots and aircrews of the Bostons get plenty of hard knocks and plenty of adventure.

Sergeant H. T. Ade of the U.S.A.A.F. was tail gunner in an A-20 which had successfully carried out a tea party raid during which the German antiaircraft fire had been particularly heavy. His pilot was flying home with one engine out of commission when three FW-190's pounced on the plane. Sergeant Ade was quick on the trigger. He got in a burst that settled the hash of one FW, just as one of the others attacked. The German's bullets killed Ade's pilot, and the Boston went into a spin. Another burst of fire ripped open the fuselage.

What happened then is not quite clear to the Sergeant, but he found himself suddenly wrenched from his turret and being pro-



The A-20 Boston or Havoc, an attack bomber found on all the far-flung battlefronts, well deserves its nickname of "Pilot's Pet." *Douglas Aircraft Co.*

Against a smokescreen background laid down by Boston bombers, paratroopers float down to capture the Jap air strip at Lae, New Guinea. *Acme.*

jected out of the plane through the bomb bay which was hanging open. He pulled the rip cord of his parachute and landed safely.

Another U.S.A.A.F. Boston returned from a low-flying raid with three German fighters on its tail. The rear gunner was wounded and unable to return the Germans' fire, which soon disabled one of the engines. In order to lighten his ship, the pilot decided to jettison his left-over bombs. He forgot, however, that he was flying only ten feet above the ground. One of the bombs, a fifty-pounder, bounced off the ground, hit the Boston that had dropped it, went clean through the fuselage and out of the top. Then it fell on the ground behind, and the explosion jolted the German fighters so severely that they gave up the chase. That seems like a fish story, but it was recorded by the Curtiss-Wright Public Relations Department, checking up on the exploits of their Cyclone engines which power the Bostons.

Another Boston engaged in a fight with three Me-109's and received a shell wound in the port engine. The explosion fractured the casing and bared the reduction gear, but the engine kept working and the rear gunner disposed of one of the pursuers.

The pilot and crew of an R.A.F. Boston also ran into trouble on one of the daylight sorties. They had been bombing a German hut encampment and from what one of them called "sheer curiosity" they made a final run over the target with the flames almost licking the wings. The "sheer curiosity," let me explain, was actually the intention of placing the last train of bombs where it could do the most damage.

When the bombardier called "Bombs away!" the pilot banked sharply to avoid some antiaircraft guns and found he was heading into a waddy, or valley, which was probably used by the Germans as an ammunition storage place. He was actually below sea level and in excellent cover, when a piece of the Boston's port wing fell off. From below another German antiaircraft gun had opened fire. The tail gunner could see a stream of bullets hitting the front of the machine and actually passing between the bomb aimer's legs.

The pilot changed his direction and climbed up and over the side of the little valley. Here the nose of the Boston clipped a telegraph pole, and the wire chipped the starboard propeller. "The note of the prop seemed to have changed," reported the pilot, "but we were still flying."

Ahead was a building, which the pilot couldn't see because his

goggles were fogged with oil. The bomb aimer must have had an anxious moment as the building came toward him at 300 miles an hour, and he tipped the pilot off. The machine's nose pulled up, banking at the same time. The starboard wing fouled a tree, but the tree came off worse, and with branches and leaves "welded" to the skin of the wing, the adventurous Boston made for home, eventually catching up with the other machines of its squadron. Safely in formation, the rear gunner spoke to the pilot. "I'm bleeding badly. Shall need some help quickly."

The Boston's pilot decided to land at an emergency field. He warned the airfield controller to prepare medical attention for the wounded man, and then flew straight in to land. When he went to let down the undercarriage, it would not work, so he landed on the plane's belly. The Boston tore a ditch through the sand and came to a dusty stop a yard away from the ambulance. Another foot or so and it would have demolished the vehicle. "Another machine, and I might not have got so far," smiled the pilot, relating his adventure.

One Boston pilot must be thanking his lucky stars for the toughness of his little bomber. He had been operating out of Pantelleria and was returning from a raid on Trapani when he came in to land and found his undercarriage would not work. He could only make a belly landing, which he accomplished safely, but as he was climbing out of the cockpit, he fell and sprained his knee so badly that he had to be carried off the field.

The mechanics went over to inspect the damaged ship. What they saw convinced them that Lieutenant "Jig" Buster was indeed a lucky man. The bomb bay of the Boston was partially open, and the bombs were still in there! What with the extraordinary anti-aircraft fire they had been through, the release for the bombs had been damaged as well as the landing gear. The bombs were armed for concussion explosion and had the Boston's air frame buckled or bent from the belly landing, the bombs would have scratched their deadly noses on the ground and it would have been the end of that machine and crew.

The fliers in North Africa have a good name for the A-20, Boston, Havoc, or whatever name you like to use for this extraordinary fighting bomber and bombing fighter, that is as near a good all-round plane as you could wish to find. They call it "The Pilot's Pet." The Boston, they say, will do anything you ask of it, and we ask and get plenty. These Bostons are likely to gain even higher honors as the war proceeds.

Chapter Ten

THE MOSQUITO

THE British claim that their Mosquito, the all-wood bomber-fighter, is the fastest bomber in the world. There seems to be nothing to disprove this claim. The Mosquito also has the distinction of being the only new machine designed and produced in England during this war, and it seems to have been designed for the special purpose of making intruder daylight raids over Germany and Occupied Europe without fighter escorts. While the Bostons are attack bombers, heavily armed and armored, the Mosquitoes rely on their speed and on the low-flying skill of their pilots to bring them out of danger.

Like most British warplanes, the Mosquito has a pedigree. It is a direct descendant of the famous De Havilland 2 pusher fighter of World War I, and of the better-known DH-9a two-seater bomber-fighter, many of which were manufactured in America during the closing days of the conflict. Its immediate parent, however, was not a warplane, but a long-distance racing aircraft designed by Captain De Havilland for the London-Melbourne race in 1934. The little machine, known as the Comet, won the race hands down from other American and British entrants, and was promptly forgotten, mainly because no one could see any practical use for such a fast two-seater.

One man did have an idea. He was Captain Hubert Broad, the De Havilland test pilot. After he had made a flight in the Comet, he remarked: "These little machines would be fine for one-bomb raids. We could get on a target and off it before anyone knew we were there."

Whether that remark, made in 1935, had anything to do with the production of the new bomber is not known, but when the Mosquito made its first appearance, its resemblance to the Comet was unmistakable. Further support to the theory that Captain Broad's idea had something to do with the building of the Mosquito is given in the fact that the De Havilland Company built the machine as a private venture and not to any Air Ministry specification. The De Havilland Aircraft Company had considerable experience

in building wooden aircraft, and as wood was considered a non-strategic material, the British government saw no good reason to hamper the production of the new plane.

The use of wood for the beautifully streamlined Mosquito was actually a considerable advantage. It meant that a large number of concerns not engaged in aircraft production could be set to work, such as furniture and piano factories, and even small carpenter shops, and that the machine would have a quality of buoyancy and lightness not present in the all-metal bomber. From the outset Captain De Havilland and his chief designer, Mr. R. E. E. Bishop, were completely sold on the sturdiness of wood construction, and so they probably went ahead on their experimental machine with confidence.

Twenty-two months after the design went to the drawing boards, the first model typed as the DH-98 was put into production and became the first military aircraft to be built by the company since 1918, when they were producing two hundred and fifty DH-9's and 10's every month. Mass production of the Mosquito was undertaken by four hundred separate firms making component parts, with similar arrangements operating in Canada, India, South Africa, Australia, and New Zealand. How many of these clean-lined bombers are now being turned out is a matter of conjecture, but the output in all parts of the world is probably higher than that of any other plane in service. Into the early Mosquitoes went wood that would normally have been used for pianos, furniture, houses, and chicken coops. Every available inch of balsa, spruce, and plywood was pressed into service, and the result was a bomber with a fighter's performance, so marked that the Air Ministry quickly asked for a fighter version of it.

The Mosquito is said to be one of the strongest planes in existence. On operational flights it has taken considerable punishment and returned intact. Large caliber bullets make clean holes in the wooden wings, and even the German explosive shells do not do serious damage. Its own armament consists of four 20-mm. cannon and four .30-caliber machine guns. It carries four 500-pound bombs, and even with full load handles as easily as a fighter. The little bomber has a reputation in the R.A.F. of being the most comfortable of the smaller bombers because of its excellent heating system. Even at high altitude, Mosquito crews do not require special clothing, and it is said that if the heating system were turned on at low altitudes, the crew would faint.

Early Mosquito raids included Oslo, Berlin, and the Phillips Electrical Works in Occupied Holland. The Oslo raid took place in bright sunshine of the morning of September 25, 1942. The Mosquitoes crossed the North Sea at a height of about fifteen feet, skirted behind a low hill which runs southeast of the city, and swooped westward toward their target, Gestapo headquarters.

"But the enemy did not let us have things quite our own way," said the pilot who led this raid. "He put up a flight of Focke-Wulf 190's, which came for us as we rounded the hill. They got one of our aircraft in the starboard propeller, but he kept on flying smoothly. That was all the damage they did, although they followed us for thirty miles before we shook them off.

"We carried on over the city, still flying low. We got a quick glimpse of the people in the streets as we rushed over them, low enough to see the Nazi flag—swastika and all—floating above the dome of the Gestapo headquarters.

"We all bombed from about a hundred feet. The crew of one aircraft saw the bombs of another hit the corner of the Gestapo's central building. This crew then bombed the west side of the quarters and a third aircraft bombed the east side. Debris and a great quantity of dark red dust or smoke was thrown up and was still hanging in the air as the crews lost sight of the city."

In telling the story of the raid the squadron leader said: "Quisling and I had an appointment in the same town." He smiled. "Quisling had a big crowd with him. I believe it was one of his party rallies. I only had a little crowd—we were in four Mosquitoes—and they gave us very short notice, but we were punctual. In formation we made for Gestapo headquarters. We bombed at nine minutes to four. The other members of the formation took the blocks to the right and left, and I went through the center block, the one with the swastika flying.

"One of our observers told me he saw all our load go through the roof. He watched the tiles flying up and thought the bombs were exploding instantaneously. But it was only the shock of the impact —the Germans still had a few more seconds to wait before the bursts. There was the Quisling holding his rally somewhere around the corner. We had not gone for him. We had gone for his German masters. Without them he could not last for a minute."

When the raid was over, the Mosquitoes were chased by a flight of FW-190's. The R.A.F. pilots determined to give the Germans a run for their money. They began to hedge-hop, skimming factory

chimneys, skirting hills, and diving into valleys. Then they headed out to sea, leaving the Focke-Wulfs behind, without a hope of catching them.

After Oslo, the Mosquitoes went into action with distressing regularity for the Germans. The R.A.F. found it necessary to institute schools giving special low-flying instructions to Mosquito aircrews. The course consisted of hedge-hopping, long-distance flights at fifteen feet above the ground on dog's-leg courses, and flying between obstacles.

It was soon found that the two men who sit side by side in the cockpit of the Mosquito had to have very special physical and mental qualities, particularly the bomb aimer, who is also navigator, radio man, air gunner, and spare pilot. If anything happens to the pilot, he must be able to bring the machine home and land it safely.

With the new bombers coming off the production line at high speed, the R.A.F. began looking for crew material in every available quarter. They wanted special men for a specialized job, and they knew that the training would have to be longer in duration than training for other types of operational flying. Likely recruits received a severe mental and physical test, then were sent to the special Initial Training Wing schools, where they were toned up physically for the task ahead. Simultaneously, they were crammed with a stiff signals and navigation course, and taught to fly. Under instruction, they flew as pilots one day and as navigators and bomb aimers the next.

With their training at the advanced stage, the applicants were sorted into two groups, pilot material and "supermen," the fellows who could do everything, navigate, operate the radio, drop the bombs, and pilot. All this was accomplished on the slower Anson trainers. Then came the transition to the Mosquitoes themselves, with training as near to active service conditions as possible.

Before qualifying, each pilot has to take the 54-foot span of the machine safely through a gap made of easily destructible obstacles. The gap, usually between paper or canvas obstacles, is about 200 feet wide in early training, and is then gradually narrowed to 100 or 75 feet. A later test demands that the pilot zig-zag at high speed through a series of poles set 50 to 100 yards apart to simulate the avenues of poplars and other tall trees found in the fortress of Europe.

The increasing use of the new bombers prompted the Air Ministry to give considerable attention to the art of low-flying bomb-

ing, and Wing Commander Hugh I. Edwards, VC, DSO, hero of the 1941 Blenheim low-flying raid on Bremen, was put in charge of a crack Mosquito squadron, every member of which had been decorated.

"Low-flying bombing is proving particularly effective," said an R.A.F. spokesman, discussing the work of the early Mosquito squadron. "Once the target is located, there is a complete absence of difficulties usually experienced in high- and medium-level bombing, such as trajectory variations, drift and changing visibility. The main requirements are speed, marked maneuverability, and high navigational skill. Speed is essential to insure surprise and evade pursuit, before and after completion of a bombing raid."

One of the pilots explained it this way: "You come in at a hell of a lick, so low you can't miss, and let go without bothering about any of the copybook lessons of bombardment." Added a sergeant-bombardier: "It's just like dropping an apple in a bucket when you are standing on a chair. The odds on a hit are greater than on a miss. The bombs have delayed fuses, of course, to give you a chance to get clear."

Mosquito bombers developed an attack technique of their own. This involved a particular type of low flying by means of which the machines hedge-hopped across enemy country, too low to be detected by German radar. By flying a high speed on the constantly varying courses, the Mosquitoes rendered the enemy's spotting system practically useless. By the time a warning had been flashed to a gun position or to a squadron of fighters, giving the course of the approaching bombers, they would be flying in a totally different direction.

Approaching the target at fifteen or twenty-five feet above the ground, the bombers flew in to attack from all directions, and then skimmed away on a zig-zag course, dodging between trees and behind houses to avoid chase by enemy fighters. This particular method of leaving the target was chosen because the average fighter plane cannot achieve its full efficiency at low altitude. Similarly, few fighter pilots can engage in combat with their wing tips almost touching the ground.

The success of Mosquito raids depended largely on preflight intelligence. The dog's-leg courses on which they flew were not chosen haphazardly. Previous to the raids, R.A.F. Intelligence officers "genned" up the pilots on every physical feature they were likely to encounter on the way. Contour maps showing houses, trees, val-

leys, railways, and telegraph lines were available. Operations were carefully rehearsed with model planes, in order to avoid the danger of collision. Usually in approaching the coast of France, one squadron would make a feint attack to draw the German antiaircraft fire, while the main attacking force would streak over the coastline at another point, sometimes with the fuselages of their planes almost touching the muzzles of the German coastal defense guns. "Once the Mosquitoes got in, the Hun had to do a lot of scratching," commented an R.A.F. spokesman. "Usually their gunners waste a lot of ammunition blazing away in all directions. A gun crew has to be very lucky to be able to get a shot at a Mosquito flying in low over its gun emplacement, and unless the gunlayers have been accurately tipped off as to the direction of approach, their chances of hitting the planes are remote."

Mosquitoes have caused considerable damage to Axis railways, both by bombing and strafing. Squadron Leader Ralston, DSO, DFM, and his observer, Flight Lieutenant Clayton (who, in June, 1943, topped the R.A.F. bombing sortie records with ninety-three raids to his credit) are specialists on this particular kind of nuisance attack. On one occasion, these two officers actually sealed a train inside a tunnel. They dropped their first bomb on the mouth of the tunnel as the train was entering at one end, and then turned and bombed the rear.

You can get some of the thrill of Mosquito flying in this pilot's description of his attack on a train. "We saw a train, going in the opposite direction, so the air gunner gave the cab of the locomotive a burst. We saw two men tumble out of the cabin. Then we banked and suddenly a church spire rushed out of the murk straight ahead and well above us. I just turned aside to miss it. My air gunner says it was a foot, but it was enough. After flying down in the yard of a big brick works, which didn't seem worth bombing, we went back to the railway and found another train. We flew at it head on, but the combined speed was too great. The bomb missed the train itself, but dropped into the tender of the locomotive. As we turned to come in again, the explosion took place, and bits of coal spattered our aircraft. We made another run and dropped two more bombs. There wasn't much left of the train. It looked just like the one in the Marx Brothers' film 'Go West.' We felt good after that!"

A navigator-bombardier back from his first raid gave me some details of the fighter plane performance of the little bomber. "The

way the pilot threw our machine about put the wind up me at first," he declared. "I'm used to climbing turns, but not to the kind of thing my pilot pulled out of the hat. We went past one factory chimney so near that I thought we had hit it. Then we dived into a sandpit and banked with the wing tip scraping the floor and zoomed over the edge in the same direction as we had entered the place. Then we ran into a flight of FW-190's, tough fellows at any time. One of them had more guts than usual. He came right down 'on the deck' with us, and sat on our tail—but only for a little while.

"My pilot went slap into an avenue of trees and he kept flying in and out of them for a mile or so. I thought he would scrape off a a wing any moment. The FW-190 followed us, and he got in a hell of a mess. He was so busy tree dodging that he didn't get a chance to shoot. When we got out of the wood and he came on, then my pilot went up. These busses climb so fast that it's really frightening. We were up 4000 feet before I knew what was happening. You talk about a Zero standing on its tail and going straight up—I'll bet those Jap machines have nothing on the Mosquito! As for the bombing, it's the easiest way. You choose a juicy spot, and let them go—plonk—plonk—and you beat it home."

Said a former Spitfire pilot: "It is no exaggeration to say that the Mosquito has fighter performance. In my opinion it is the loveliest, cleanest, low-level aircraft in service, and personally I would not change my type of work for anything in the R.A.F. The first time I was chased by an FW I was in a sweat. All I could think of was what I might have done if I had been in a Spit. I opened up, but nothing very much happened. Then suddenly my machine shot forward as if I had given her the gun a few seconds late. What had been holding her back? I saw my navigator grin. Afterwards he explained. The bomb-bay doors were still open when the FW had come on us, and the drag held us back. When they were closed, we just showed the FW our tail, and that was that. I had another bad moment, when one of my engines was shot up, but the machine came home on one engine, behaving perfectly."

Like other low-flying machines, the Mosquitoes sometimes hit objects on the ground. One machine came home recently with a tree branch in its fuselage, another cut off the top of a German radio mast and brought ten feet of steel tubing with it as a souvenir.

The pilots are a bit shamefaced over things like that, however,

because it shows they "boobed" a turn. One pilot got exceedingly red in the face when some bricks were found in the cabin of his Mosquito.

"I took them for ballast," he told the Intelligence officer, who suspected him of some bad turns. Actually he had come in over the target too soon after the man ahead. His machine literally flew through the bricks of a house which went up from the explosion of the delayed-fuse bomb.

The most dramatic raid in which Mosquitoes figured was the attack on Berlin to "celebrate" the tenth anniversary of Hitler's regime. Two separate surprise attacks were made on the city, once while Goering was about to make a radio speech, and again when Goebbels was scheduled to speak. The raid was a routine one for the Mosquito squadrons, with the exception that the machines were equipped with special machines to record the sound of the bomb explosions so that they could be heard in the R.A.F. operations room in England. "Waiting for the big bang was quite dramatic," wrote an R.A.F. correspondent. "All the backroom boys were waiting, and pretty tensely. Then we heard the first bang, then another. 'They've done it,' burst out someone. 'They're giving Hitler hell!' Someone frowned at him for his language, but there were happy faces in that operations room."

This particular Berlin raid was planned for its psychological effect. Goering, who had promised the Germans that no hostile plane would ever fly over Germany, was about to speak. The thudding of bombs caused him to postpone his address for an hour, and the presence of the little bombers, one of which darted up the famous Unter den Linden at treetop height, kept the German radio silent for an hour, while the British had the gleeful experience of hearing the commotion over their radio.

The mass production of Mosquitoes soon enabled the British to service them to outlying fronts. Squadrons of Mosquito fighters were sent to Malta where they showed they could turn in a smaller circle than the German FW-190's, and a large number of the little bombers were stationed in North Africa, where they were used for day and night bombing. Operating in the Mediterranean, the Mosquito demonstrated its quality of buoyancy to great advantage. Shot down in the sea, one of them remained afloat for eight hours, an all-time record for an airplane.

Mosquitoes are now used as night fighters and for photographic work and communications. One pilot left England in the morning

with urgent dispatches, arrived in Moscow for lunch and was back in England in time for tea. Another made the run from London to Malta in an afternoon, and flew back to England with a high official as passenger, arriving for lunch the following day.

The Mosquito's extreme versatility soon challenged that of the Hurricane, which has been used as a fighter, fighter-bomber, a dive bomber, a night fighter and a reconnaissance machine, but it also encouraged the R.A.F. to develop the rugged Typhoon fighter into the light-bomber class. Typhoons equipped with four 20-mm. cannon and carrying two 500-pound bombs now accompany Mosquitoes on daylight intruder raids over France and Italy, and do particularly good work against enemy shipping. The Typhoon, although primarily designed as a fighter, seems to be ideally suited for the task of light bombing, and thus it is following in the air train of its distinguished ancestor, the Hawker Hart, in its day the finest all-round machine, and basic design for the Hurricane.

Chapter Eleven

DIVE BOMBERS

TOWARD the end of the last war, the Allies began to use their scout planes extensively as bombers. The planes carried their bombs on exposed bomb racks underneath the wings, and the pilots had no bombsights. In order to make sure of a hit, they evolved the practice of diving down to the target, dropping their bombs at about two hundred feet above the ground, and zooming away to safety at top speed.

This method of bombing proved exceptionally effective because the speed of the scout plane enabled it to dodge normal antiaircraft fire, as well as machine-gun emplacements protecting the target. In executing this kind of attack, the pilots were making the best of a bad job. They did not like carrying bombs, because the additional weight curtailed the maneuverability of their planes, and they felt that they could not measure up to the accuracy of the

medium-bombing squadron boys who had been through bombing school and learned to operate the existing bombsights. Their habit of diving and letting go was their way of making the best of it, and their planes were the predecessors of the modern dive bomber.

For some reason or other, the British, who had begun the practice, went no further with their experiments in this close-range bombing. In America, military-minded people remembered it and set to work to develop planes designed for the work.

Dive bombing is the practice of aiming an aircraft at a target and releasing the bomb at the moment the nose of the machine is pointing dead at the target and as close as is feasible to enable the pilot to pull his aircraft out of its dive and take evasive action. The principle of dive bombing is the same as that of aerial gunnery with fixed guns. Pilots of the dive bomber and the fighter both aim their machines at their target. While the fighter pilot has a destructive power limited to the number of rounds of fire he can discharge in the few seconds when his aim is true, the dive-bomber pilot can release a thousand-pound bomb, the trajectory of which, if he has kept his machine steady and aimed true, will follow the line of flight of his dive, if he had continued it. Dive bombing is perhaps the nearest conception to long-range artillery that could be desired. Your gun is the plane; you fly it to the target, aim it, and "fire" the heavy shell, using the speed of the plane and the weight of the bomb as a propelling force.

The German Stuka is undoubtedly the most famous dive bomber in the world, because of its destructive exploits over Poland, France, Greece, and North Africa. In developing their Stuka, or Junkers 87, about the meanest-looking machine you could ever see in the air, and incidentally one that had been previously foisted on Europe as a civilian, the Germans did a neat and unashamed piece of plagiarism. Their first model, innocently built in Sweden, was fitted with a British Bristol Jupiter engine.

However, the dive bomber happens to be an American invention. To American designers and American military minds goes the credit for having first thought up this formidable weapon, and it might not be out of place here to say that American dive bombers are without doubt the best of the type in the world, being faster and tougher, and packing greater punch than those of the Axis, although, as we shall see later, the other side is still likely to put some of its heavy bombers into the dive-bombing business.

Dive bombing has both advantages and disadvantages over level-

flight medium bombing. The latter have been shown up by the Stuka, which is an inferior weapon to the modern American machine mainly because of its great age. Among the advantages are the high degree of accuracy possible in daylight even in bad weather conditions; the dive bomber can approach a target obscured by clouds and still be sure of a direct hit, provided the pilot sticks to his job. In this respect, it is exceptionally effective in attacking ships, airfields, and enemy defenses which must be leveled before an attacking army can advance. It carries a much heavier weight of bombs than the average fighter-bomber, over a greater distance, and it is no more vulnerable to antiaircraft fire than other forms of low-altitude bombing.

Of all aircraft, the dive bomber has the great advantage of being able to approach the target without flying straight and level or on a set course. Only when in its dive need it fly straight, and it takes pretty good shooting for an antiaircraft gunner to hit a plane diving at 250 to 300 miles an hour. It does happen, of course. I saw a Ju-87 sustain a direct hit from a Bofor gun during the Battle of Britain. It was remarkably good shooting, but it might have happened to any plane.

The disadvantages as revealed by the German Stuka are slow speed, and extreme vulnerability to fighter attack through lack of armor and defensive armament. Fully loaded, its maneuverability is limited.

The earliest news of American experiment in dive bombers was in the early twenties, when the United States Navy and Marine Corps undertook experiments using Curtiss and Boeing pursuit planes. In 1928 Glenn Martin produced a specially designed biplane capable of carrying a thousand-pound bomb, a remarkable achievement for those days. Little more was heard of the MB-1, but two years later the Curtiss-Wright Corporation produced the first of the series of dive bombers known as Helldivers.

This first Helldiver was a small two-seater biplane with a swept-back top wing. It was powered by a direct-drive Wasp engine and fitted with two fixed guns firing forward from the upper panel of the center section and a swivel gun in the rear cockpit. The machine carried a fifty-pound bomb beneath the fuselage and was designed specially for dive-bombing operation from aircraft carriers. This model had no dive brakes.

In 1933, the basic design was considerably modified and the United States Navy and Marine Corps took delivery of a new ver-

sion of the Helldiver, which had a twin-row radial engine and considerably better performance.

Dive-bombing experiments proceeded with these new machines, and practice suggested further alteration. So, in 1937, a newly designed Helldiver, known as the SBC-3, began to operate from carriers of the United States fleet. This model had double split trailing-edge flaps to act as brakes during the dive. It was powered by a Twin Wasp Jr. driving a constant-speed airscrew and it featured a retractible undercarriage.

The SBC-3 operated for several years on United States carriers, to be succeeded in 1939 by the SBC-4, a sturdy little machine powered by a Wright Cyclone engine. The SBC-4, which still flies for the R.A.F. under the name of the Cleveland, has a maximum speed of 245 miles per hour and can carry a thousand-pound bomb load over a short range. The bomb is carried under the fuselage, but there are special bomb racks on the wings, so that on long trips the main bomb rack may be used for an auxiliary fuel tank.

Having experimented for many years with dive bombing and low-flying attack, it was to be expected that the United States Navy entered the war with several types of dive bombers. The type that has probably seen more action than any of the others up to the present is the SBD-3, Douglas Dauntless, termed by the Navy a scout bomber. These planes work from aircraft carriers, the complement of which is usually a squadron of fighters, one of scout bombers, and another of torpedo bombers. The Dauntless, a cousin of the A-20 Boston, is a development of the Northrop A-17 attack plane and is said to be capable of a high degree of maneuverability. With a span of 41 feet, 6 inches, and a loaded weight of just over 8000 pounds, the shapely Dauntless is only slightly heavier than our new fighters. It carries a crew of two, a pilot who has two forward-firing guns, and a rear-seat man who is radio operator and gunner for the flexible gun. The Dauntless carries its bomb, either a 500- or a 1000-pounder, underneath the fuselage. It is fitted with perforated flaps to reduce its speed on the dive.

When these formidable dive bombers first went into action in the Pacific, Jap pilots thought they would be easy meat and swarmed round them like furious gnats expecting to have an easy kill. Again and again the rear-seat men of the Dauntless blew the Zeros to pieces, while the pilots acquitted themselves effectively by swooping and turning to bring their fixed guns on the enemy planes.

Henderson Field on Guadalcanal is named after Major Lofton Henderson, who dived on a Jap carrier so low that he crashed into the "island." It was an act of supreme heroism, typical of the standard of dive bombing adopted by the Marines, who had announced previously that they were going to drop their bombs right on the flight deck of the enemy carriers.

During the Battle of the Coral Sea, Dauntless planes were credited by the Navy as being the most effective of their offensive weapons. They played a major role in the Allied amphibian attack on Casablanca and the adjoining North African coast. Squadrons of these fast tough dive bombers roared down through the most intensive antiaircraft fire to attack Vichy harbor installations, docks, and gun positions. The most outstanding feat of these Navy pilots was putting out of action the great French battleship *Jean Bart*. SBD-3's scored several direct hits with small bombs, and when it was found that larger armament was needed to do the job, they returned to their ship and loaded up with heavier material.

One attack with these larger missiles put the big ship's guns completely out of action. The small caliber antiaircraft fire around Casablanca harbor was as heavy as any experienced in this war. Many of the scout bombers returned riddled with holes. One got back and landed safely on the carrier with its flaps shot away, after surviving more than three hundred bullet holes, demonstrating well the sturdiness of this dive bomber.

Douglas Dauntless dive bombers were included in the air group operating from the U.S.S. *Enterprise*, the aircraft carrier that has been in the forefront of every naval action in the Pacific. The *Enterprise* planes accounted for three enemy carriers, helped to sink another, and sank or damaged a long list of enemy vessels ranging from patrol boats to battleships. One of the *Enterprise*'s Dauntless pilots scored a direct hit with a 500-pound bomb on a Jap carrier, and the same squadron laid more than 2000 pounds of bombs on a battleship of the Kongo class.

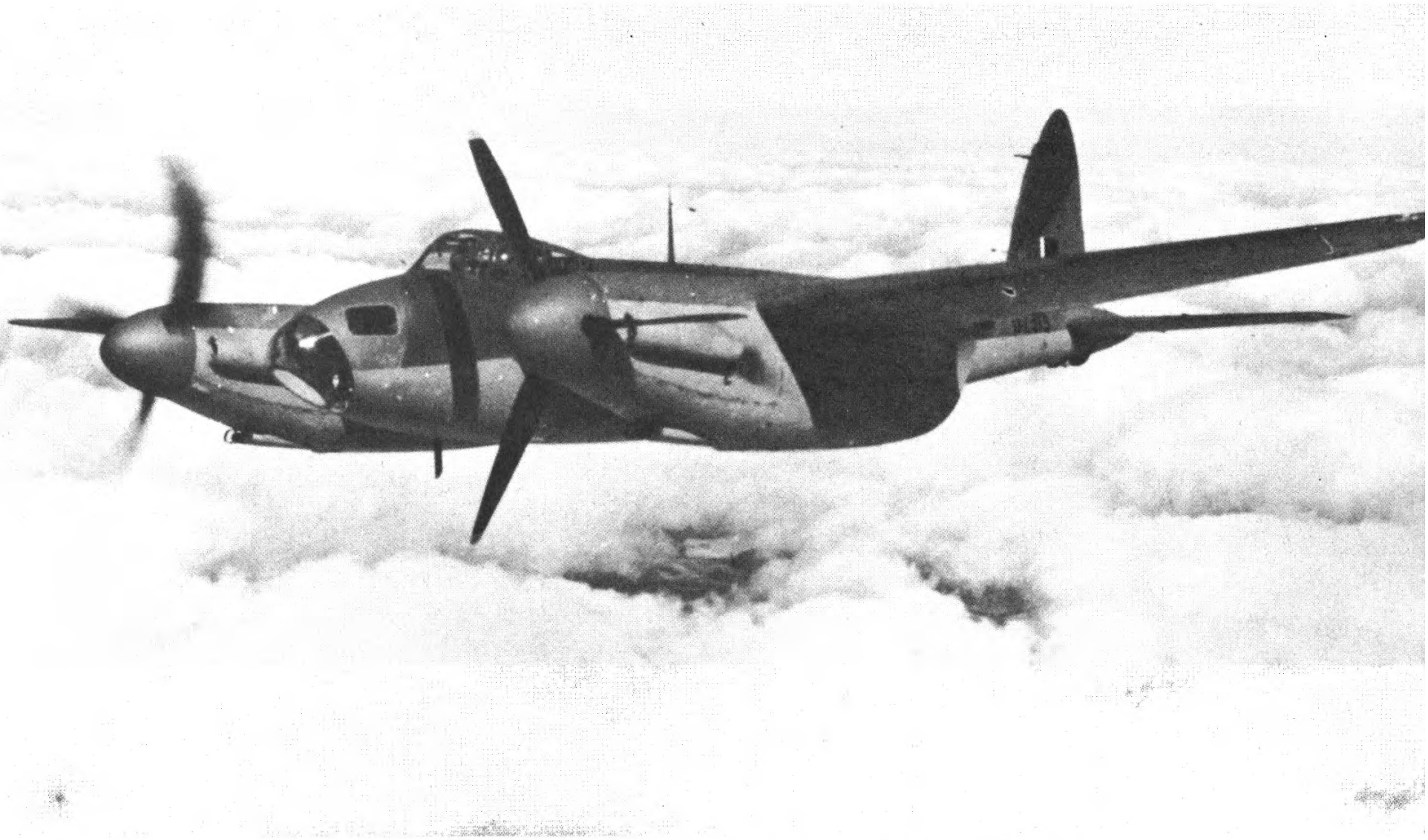
Dauntless pilots and crewmen endured almost incredible encounters with Japanese Zeros and patrol bombers. Captain Robert W. Vaupell, U.S.M.C., whom I met at the Navy's Air Base at Corpus Christi, Texas, gave me some first-hand stories of Dauntless ruggedness. Vaupell was operating at Guadalcanal in the same squadron as Colonel Richard Mangrum, the Marine who sank a Jap battleship. At twenty-five, Vaupell wears the Navy Cross, the Air Medal, and the Purple Heart.

"Two of us were out on a scouting mission on October eighth," he said. "My wingmate was Jack Blumensten. We were carrying bombs, but our primary objective was to locate the position of enemy surface craft. I had just spotted some Jap ships when eleven Zeros jumped on us from out of the clouds. Suddenly there were Zeros all around us, spitting tracers and shells from every direction. I saw Jack go down in a spin. There were three Zeros on his tail, and I figured they must have got him. I was on my own. I got my report back to base as to the position of the Jap fleet, just before a Zero shot my radio out. They had done more than that. I hopped into a cloud for safety and found that all my instruments were out of order. Bullets had ripped up and down the cockpit while we were getting our report off. I couldn't fly in the cloud without instruments, so I put the machine into a spin. I came out about a thousand feet above the Jap ships!

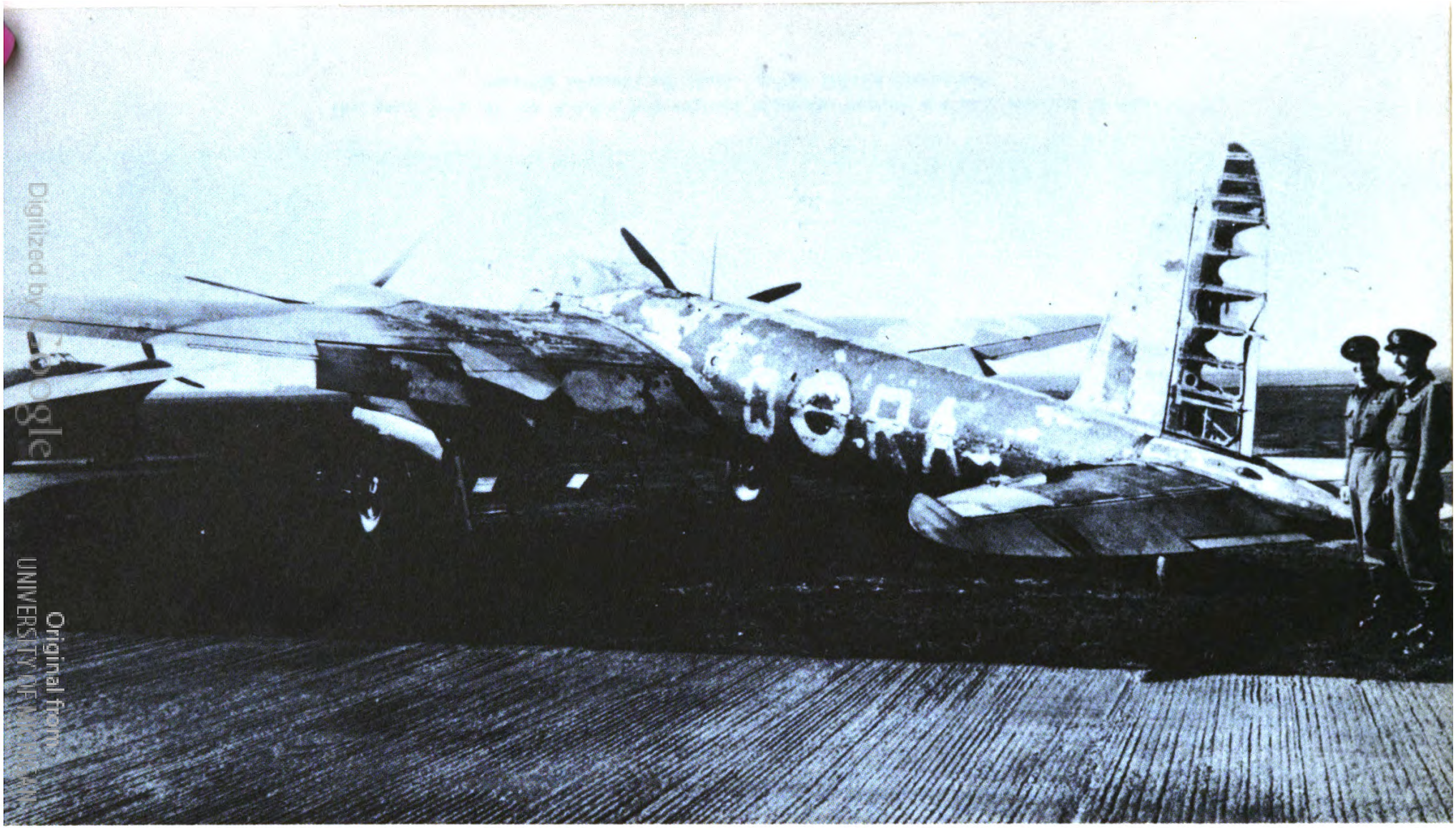
"What happened then is something to remember. The ships' antiaircraft let go with everything they had. That was lucky for us, because the Zeros who had come up to tail me beat it, for fear of being hit by their own gunners. There was another good thing too. The Jap antiaircraft fire was poor, as poor as I've seen, and it did little damage, although a few bits of shrapnel hit our wings. I was too low for any dive bombing, but I wanted to lose some weight, so I let go my bomb. It didn't hit, but it must have shaken the ship below a trifle. I was glad to be rid of that thousand-pound weight, and I made for another cloud. I found a nice one, the big puff-ball kind of cumulus you find in the Pacific, and stayed there for about five minutes, flying by instinct. Then I had to come out. Waiting for me were eleven Zeros. Three of them got close in and filled my cockpit with bullets. One of the planes that had hit me then did the silliest thing. He came up in front of me in a slow climbing turn. I got him with my forward-firing guns. He simply exploded, and I felt better, even though I'd been hit four times, three times in the right leg, and once in the left. Then my rear-seat man gave another Zero the works, and he went down flapping.

"The others made off and left us. Our problem then was to get home. We threw everything overboard to increase our speed and finally we landed on the very edge of our field."

When Vaupell got back, he found the pilot of the other dive bomber waiting for him. He had accounted for two or three of the Zeros and had reported Vaupell as surely missing. Both of the Dauntless planes were riddled with bullets, and one had survived



The good looks of the R.A.F.'s twin-engined Mosquito bomber are only equaled by this versatile aircraft's efficiency. *British Official Photograph.*



This R.A.F. Mosquito, on intruder patrol with the Fighter Command, made its base. Backwash of burning oil from an enemy plane set it on fire; the port engine went dead; the port wing inboard of the engine, the bottom of the starboard wing, the port tailpiece, and the rudder fabric were torn away. ***British Official Photograph.***

several hits by Jap cannon shells. No wonder the United States Marine Corps pilots swear by these dive bombers.

The Dauntless is a comparatively old dive bomber today. Considerable improvement has been made in the design of this plane, as shown by the specification of the Brewster Buccaneer, one of the United States Navy's more recent dive bombers, known as the Bermuda to the British, who have ordered considerable numbers.

The Buccaneer is powered by a Double Row Wright Cyclone and seems to have been designed to eliminate all the faults of the Stuka and the Dauntless, particularly those in regard to vulnerability. It is heavily armored and carries an astonishing number of guns, six .50-caliber firing forward, and two .30-calibers on a twin mounting in the rear-seat man's cockpit. The bombs are carried internally.

The Buccaneer is fitted with perforated double split flaps that act as dive brakes, the perforations being fitted to reduce tail buffeting brought about by the disturbance of air flow from the resistance offered by solid flaps. Its speed is said to be in the neighborhood of 300 miles per hour, which is probably a conservative estimate.

The Buccaneer was not put into action by the United States Navy, being used for training only, but the British Fleet Air Arm, which has used it extensively, says it is the best dive bomber in the world.

The United States Navy had good reason for not using the Buccaneer—something better.

In 1942, an announcement was made that a new Helldiver was in production. This was typed the SB2C-1 and was universally acclaimed as the answer to the German Stuka. The SB2C-1 is a low-winged monoplane weighing about 11,000 pounds loaded and exceedingly heavily armed. It is powered by a Double Row Wright Cyclone of 1700 hp. and is said to be 100 miles per hour faster than current types. It is fitted with trailing-edge dive brakes and with leading-edge slots. The bomb load is carried internally and the machine is readily adaptable for use as a torpedo bomber.

The Helldiver came in for some criticism by the Truman Committee, but the Navy people just smiled and went on developing their new weapon, which they knew was the most up-to-date of its kind. Into it had been put every available combat lesson, formidable armament, and the sturdiest construction. Until the Helldiver went into action for the first time the machine was very

much of a mystery. People talked about it, some said it was a lemon, others that it was the super dive bomber. Neither side knew which was right.

On November 11, 1943, the Helldiver made an auspicious debut in the United States Navy's raid on Rabaul, and wrote its own history in a few crowded minutes. It taught the Japanese a few things, and entirely justified the confidence placed in it by the Curtiss-Wright Corporation, its designers and builders, and the Navy Bureau of Aeronautics.

The action was as dramatic as any fought in the Southwest Pacific. At dawn a United States carrier task force crept up to within airplane range of the Japanese-held stronghold of Rabaul. The task force was a streamlined unit equipped with the United States Navy's latest weapons, the Helldivers, Hellcat fighters, and Avenger torpedo bombers.

The Helldivers rendezvoused after the take-off, and climbing to their altitude moved in to attack the harbor which was massed with shipping. Lieutenant Commander Vose, the squadron commander, ordered his men to step up their speed and push over into their dives before the ships could break anchorage and make for the sea. The Japanese had got some planes into the air. To the attack came eight Zeros. The enemy planes never reached the formations of Helldivers. The escorting Hellcats saw to that. The sky was filled with burning, bursting Jap fighters.

Down with the Helldivers. The Jap warships tried to escape to the open sea, milling and turning in the harbor like disturbed ants. The big bomb-laden Helldivers gave them little chance. Each section of the planes chose its target and laid its eggs with precision accuracy. One Jap light cruiser went to the bottom in a few seconds with three direct hits. From another vessel, a heavy cruiser, shot up a tower of bright yellow flames which told the Navy pilots that it had been hit in the magazine. Another dive bomber laid its bomb smack on the fantail of a destroyer, and two other Helldiver pilots hit a light cruiser, blowing up its superstructure. A second destroyer, wrecked by a hit and a near miss, went out of control. Said the Navy release: "The Helldivers had a field day at Rabaul." Said Admiral DeWitt Clinton Ramsey, Chief of the Bureau of Aeronautics: "The plane had demonstrated that it packs a terrific wallop for the Japs."

The sting of the story is in the tail, however. After the attack, in which more than 28,000 pounds of bombs were dropped, the

Helldivers roared back to their carrier utilizing all available cloud and rain squall cover. They had been attacked by enemy fighters when they pulled out of their dives, the dive bomber's most vulnerable moment, and not one had been shot down. Some of them were cut off and encircled by a large number of Zeros. They fought their way through the attacking Japs without loss, leaving three Zeros in the sea, and one in a damaged condition. Then they showed the enemy their tails and made for home. Two of these planes were later lost through fuel exhaustion, landing near their carrier. The personnel was saved.

Thus for the loss of two bombers, the Helldiver squadron sank one light cruiser, and two destroyers, and damaged two heavy cruisers, one light cruiser, and eight destroyers. During the action the escorting fighters destroyed eighty-eight enemy planes.

Five Helldivers remained on defensive patrol over the carrier to keep Jap surface vessels at a distance, and according to the Navy communique: "These played a substantial role in beating off the determined Japanese attack against the American task force."

The Helldiver is built by Curtiss-Wright and two Canadian associations, Fairchild of Canada and Canadian Car and Foundry Company. The Helldiver is also being manufactured for the Army, under the designation of A-25.

Another American dive bomber which has won high praise from the British, for whom it was originally made, and which has already been in action with the United States Army Air Forces, is the Vultee Vengeance. The Vengeance, or A-35, is said to have been put into production at the request of the British Purchasing Commission in 1940, when the R.A.F. realized the crushing blows handed out to Allied land forces by the German Stukas. Although the British had two machines which could have been used as land-based dive bombers, superior in performance to the Stuka (the Blackburn Skua and the Hawker Henley), they decided to purchase their dive bombers in America.

The Vultee Vengeance looks rather like the Stuka in form, with its swept-forward wings and slim fuselage. There the resemblance ends. The Vengeance represents a considerable technical advance over the Stuka, and, like the Buccaneer, it is sufficiently well armed to defend itself and act as a ground strafer. The power unit is a Double Row Wright Cyclone, and its range is in the neighborhood of 1400 miles with a 2000-pound bomb load.

The first report of action by the new dive bomber came from

the Pacific theater of war and was heavily censored. Its debut was sensational and effective, however. An Allied advance was being held up by a deep pill-box defense system. Five batteries of artillery that had been trying to overcome the defense had been decimated. Six Vengeance dive bombers were dispatched to clean up the nuisance. According to the report, they dived from 11,000 feet at an angle of ninety degrees and dropped their bombs on the target in a perfect pattern. So effective was the attack that the enemy's strongholds were completely knocked out, and the Allied troops were able to advance. The United States had turned the tables on the Axis, giving the Jap a taste of what the Stukas had given the Poles and the French. Each one of the Vengeance planes returned to its base. Said the United States Army, commenting on the action: "The Army wants more of this type of aircraft in this area."

As a land-based dive bomber, the Vengeance seems to have solved the dive-bombing problem of the United Nations.

There has been an increasing tendency on the part of the air forces of the United Nations to use light dive bombers. The British set the fashion by employing a modified version of the Hurricane fighter. These machines, each carrying one 500-pound bomb, made their appearance first over the French coast and later in the North African campaign. They were fitted with four 20-mm. cannon and seem to have been extraordinarily successful, performing the double function of strafing as well as dive bombing, without dive brakes.

The use of fighter planes on the part of the British seemed to be a reversion to World War I experiments. It seemed to be an attempt to find a machine to do the same job as the German Stuka, with none of the disadvantages. Better armed and armored than the German dive bomber, and considerably faster, the Hurricane was ideal for its new job. Once rid of its bomb, it could hold its own against the German fighters. Rommel's men soon learned to fear the Hurricane. In one instance, after two dive-bombing attacks by these machines, the German Stuka pilots refused to take the air when threatened again.

Later came the news that the North American Mustang P-51, originally designed for the British as a reconnaissance machine, had been fitted with dive brakes and put into service as a dive bomber under the name of A-36. The A-36's made their first combat sortie

against Pantelleria, and according to reports, they bombed with "devastating" accuracy. On one day alone, July 10, 1943, the new dive bombers made seventy sorties on six missions. Their targets were gun emplacements, railway junctions, sidings, depots, supply centers, and the Luftwaffe headquarters in Sicily.

The use of these fast machines as dive bombers is rather like delivering short punches in boxing. One Mustang pilot describing the action in Sicily said that once he had dropped his bombs, his machine became one of the best fighter planes in the world. On one occasion he chased an Me-109G with a five-mile start and overtook it inside forty miles. He caught the German plane on the top of its loop as it was trying to escape and shattered it. His description of dive bombing is illuminating. "We come over the target high," he said, "and then dive almost straight down, keeping the target in sight for several thousand feet. Then we let go, pull back the stick and start looking for fighters or something to strafe."

The success of the Mustang-turned-dive-bomber may have a considerable effect on our warplane production. If the plane is as good as the reports, it may become the standard single-engined dive bomber of the United Nations. An invading army supported by thousands of these machines would be many times more effective than the Germany army when it marched into Poland and France behind the explosive curtain of destruction dropped by the vulnerable Stukas. With its speed and its invulnerability, the A-36 seems to be the ideal weapon.

Chapter Twelve

TORPEDO BOMBERS

THE torpedo bomber is the cousin of the dive bomber. Carrying a torpedo under the fuselage, the torpedo plane dives down to a few feet above the surface of the water. The pilot aims his plane at the target, releases the torpedo, and takes evasive action. His

task is considered one of the most hazardous in aerial warfare. It calls for cool courage and considerable determination.

When attacking a battleship or enemy aircraft carrier, he has to penetrate the protective screen of shell fire thrown up by the ship's heavy guns, and then he approaches his target usually under fire from small rapid-firing cannon and machine guns. All this in addition to brushes with enemy fighter planes.

Torpedo planes have been extraordinarily successful in their contacts with battleships, considerably more so than dive bombers. One British aircraft carrier survived seven direct hits from large bombs from Italian dive bombers, but few battleships have survived concentrated attacks by torpedo planes. The Japanese used torpedo planes against the *Prince of Wales* and the *Repulse*. They also sank a British aircraft carrier and two cruisers in the Indian Ocean by torpedo plane attacks.

The torpedo plane seems to have been a British invention. The British Navy started experimenting with this type of craft before the outbreak of World War I. At the end of the war they had used torpedo planes with great effect from both land and carrier bases. In 1914 the Blackburn Aircraft Company, manufacturers of the Skua, the R.A.F.'s standard dive bomber, had produced a formidable twin-engined biplane called the Kangaroo, which was armed with a full-sized torpedo.

At the outbreak of World War II, the British Navy's Fleet Air Arm and the R.A.F.'s Coastal Command had two types of torpedo bomber in service, the Fairey Swordfish and the Albacore, both biplanes. The comparatively old Swordfish did a variety of jobs, from dropping parachute mines into the Baltic and along the coast of Norway to attacking German surface ships during the occupation of Norway. They played a major part in the Battle of Taranto when the Italian fleet came off so badly under the assaults of their bombs and torpedoes. When aircraft carriers of the British Atlantic fleet closed in on the German battleship *Bismarck,* Swordfish and Albacores slowed up the pride of the Germany Navy and enabled the big guns of the British ships to finish her off. They performed similar tasks in the Battle of Cape Matapan, and justified the British belief in this form of sea attack, although the Swordfish with their speed in the neighborhood of 150 miles per hour were hopelessly out of date and woefully lacking in general plane performance. The Swordfish carried two men; the Albacore three. In the light of history, and the jobs they tackled, the crewmen of

these old crates with their scant armament or armor rank among the unsung heroes of aviation.

There seems, in fact, to be no age limit to torpedo planes, or at least that was the popular conception up to the outbreak of war. One of the most pathetic stories to come over the news wires was that an R.A.F. squadron was operating from Singapore during the Japanese attack with ancient Vickers Vildebeests which made their appearance in the twenties. The correspondents, in reporting their presence sailing through the clouds of smoke and fire over the beleaguered fortress, remarked that they seemed incredibly slow. Why they should have been sent to defend one of the Empire's most important bastions in the Orient is a mystery, although one reason may have been that the Japanese torpedo planes were almost as ancient.

The R.A.F. Coastal Command, which is distinct from the Fleet Air Arm, decided that with certain modifications the Bristol Beaufighter would make an ideal torpedo plane, and consequently the Beaufort was put into production.

The Beaufort can operate from a carrier or from a land base, and it is similarly adaptable for bombing and reconnaissance. It carries a single torpedo in the bottom of the fuselage. For bombing purposes, the torpedo carrier is easily adjusted to a bomb bay. At first sight, the Beaufort closely resembles the Blenheim, its wings being the same shape, which enables them to be used as replacements for either type machine. The Beaufort carries a crew of four—a pilot, navigator-bombardier, radio operator, and gunner. It is heavily armed with two guns in a turret amidships, two firing forward, and one firing to the rear by remote control.

The Beaufort, according to the R.A.F., has probably flown more operational miles than any other similar type of machine. It has been constantly at work preying on enemy shipping in the Atlantic, the English Channel and the Mediterranean, and recently made its appearance in the Indian Ocean where the Japs named it the "Whispering Death" because of its habit of creeping up without warning on ships, going into its run, and coming almost to a standstill with flaps open and engine switched off, to launch its torpedoes. The Beaufort's score of enemy shipping accounted for runs into thousands. It has been used extensively as a mine layer, and has executed hush-hush missions which can only be told after the war. One of the most daring exploits of the Beaufort was that of a single plane which flew through the defenses of Brest on the west

coast of France, and torpedoed a German cruiser lying at anchor, escaping without even being hit. Another Beaufort of the Coastal Command attacked the German battleship *Tirpitz* in the Trondheim Fiord in Norway, flying down between the mountain tops to deliver its tin fish.

The machine is well able to defend itself, and like the Sunderland has earned the respect of the German fighters and reconnaissance planes. A Beaufort on coastal patrol off the coast of Norway gave battle to two German Arados and a Heinkel seaplane. One Arado and the Heinkel were shot down. The third plane fled, and the Beaufort continued with its job of laying mines in the entrance to a fiord. In the English Channel just before dawn two Beauforts came upon a German destroyer escorting a flak ship into position. The pilots decided to lead the Germans a dance, and came down low to attack the beam of the destroyer, which expected a torpedo, and began to maneuver at top speed, so fast that its anti-aircraft guns were not able to get into action effectively. The Beauforts had only gun fire with which to attack the enemy, but they made good use of it, setting the destroyer's deck house on fire, and doing considerable damage to the new flak ship.

Beauforts are manufactured in Australia as well as in England, and they have already been in action in the East, where they play havoc with Japanese ships. Their extensive range and heavy armament make the Beauforts a formidable weapon against an invasion fleet or enemy carriers operating against hostile coasts. Considerably faster than carrier-based torpedo bombers, and capable of a much heavier load over greater distance, these aircraft may eventually figure largely in the amphibious warfare that must eventually crush Japanese power in the Pacific.

The United States Navy's interest in torpedo planes began during the last war and continued steadily, differing from that of the British in that American planes were far in advance of the Swordfish and Albacores in all-round performance. United States torpedo planes, such as the Grumman Avenger and the Douglas Devastator, have played a large part in smashing Japanese air power in the Pacific. During the Battle of Midway, Martin Marauders fitted with torpedoes tore into the Jap fleet and did considerable damage. There is also talk of using a modified version of the Douglas A-20 as a land-based torpedo plane.

The Douglas TBD Devastator, first monoplane torpedo plane in

the world, is said to be more than 100 miles an hour faster than the Swordfish. It went into service in 1938 with squadrons attached to the *Saratoga, Yorktown, Enterprise,* and *Hornet.* Powered by an 825-hp. Twin Wasp Jr., the Devastator carries a crew of two, and has a maximum speed of just over 200 miles per hour.

The main criticism that can be leveled against the Devastator is that it seems to have been underarmed and insufficiently armored, as is evidenced by the heroic epic of Torpedo Squadron Eight, which lost all but one plane during the Battle of Midway. The reason for these losses may also have been partly due to lack of fighter protection, and the extraordinary daring of the pilots. Certainly the heavy losses of these planes caused the designers to give considerable attention to the armoring and armament of subsequent models, and today the gallant Devastator is obsolete, being replaced by the Navy's Grumman TBF Avenger, which made its sensational debut at Midway.

The Avenger looks rather like a bigger brother of the Grumman Wildcat, with its square-cut wings and thick fuselage that tapers at the rear under the fin. It is powered by a 1600-hp. Wright Cyclone, which gives it a speed of some 300 miles per hour. It is probably as heavily armed as the Beaufort, and can carry either bombs or torpedoes.

On a recent visit to a naval base, I saw Navy pilots engaged in operational practice on the Avengers. The big-bellied machines swooped down at fighter speed, skimmed the water at low altitude, and then soared into the sky with astonishing speed. It was easy to imagine what a shock the Japs had when these "flying tanks" burst on the scene in the Pacific and dropped their 21-inch torpedoes with deadly precision.

United States Navy torpedo tactics are probably the most advanced of all the belligerents, being the result of many years' experiments, and of continued action in the Pacific. The aim of the torpedo plane pilot is to deliver his missile on the target about fifteen to thirty feet below the surface of the water. A hit on the hull of a ship at this depth strikes the most vulnerable spot, where the water pressure helps to hold the explosion in, so that it will exert the fullest pressure against the hull.

Modern ships have developed highly effective evasive action against torpedoes, so the pilot must get in close to drop his torpedo from about three hundred feet. His plane must be absolutely level. If it were diving, the torpedo would go into the water at an angle

and dive too deeply, or perhaps nose over entirely and come out in the wrong direction. If the plane is climbing, the torpedo will porpoise.

Torpedo planes approach their target usually under cover of fighters, and then peel off, diving from out the sun, or from the darkest part of the sky if the attack is at dusk or dawn.

Once lined on his target, the pilot must keep his plane level and when in range, he opens his flaps and reduces his speed until the machine is almost stalling. This is to reduce the shock of the torpedo, with its delicate mechanism, in hitting the water.

The principle behind torpedo attack is not so much to sink a ship with one knock-out blow, but rather to deliver a series of hits from all angles, each of which will slow up the vessel and make her a better target for dive bombers or big guns. Torpedo planes usually come in to attack in echelon, with ample space between planes to enable them to break away in either direction, and to avoid the danger of enemy fire being concentrated on more than one machine.

The attack is usually delivered from the beam and forward, so that the ship presents the greatest possible target. Sometimes the torpedo planes attack from the front of a ship, coming in low, and then each plane of the line turns alternately to port or starboard, to what is known as double attack, striking simultaneously on either side of the ship. The planes move in from both port and starboard bows spaced ninety degrees apart, their speed synchronized to bring each plane on the target at an interval of one minute. This method minimizes the chance of the captain of the ship maneuvering his vessel to avoid attack by bringing his ship parallel to the torpedo plane, as might be possible in a single attack. Should he manage this in the case of the attack from port, the ship is still a target for the torpedo released by the starboard plane.

Various other methods of attack are used. Sometimes a torpedo attack is preluded by the laying of a smoke screen, to facilitate approach. The planes dart in and out of the screen, which hides them from hostile antiaircraft fire and fighter plane attack. They pounce on their target and withdraw into the smoke screen again.

The ideal attack on a battleship or aircraft carrier is delivered by an air group consisting of fighters, dive bombers, and torpedo planes. The fighters attempt to draw off the carrier's fighters; the dive bombers attack, drawing the fire of the antiaircraft guns; the torpedo planes sneak up from unexpected angles and deliver

their deadly weapons. The advantage of such an attack is that its threefold nature causes the ship to dissipate its fire.

The United States Navy is said to have a new, improved type of super-torpedo plane in the process of development. This is the Chance Vought Sea Wolf, a brother of the famed Corsair fighter. The Sea Wolf will probably have a longer range and greater armament than any existing torpedo plane, and might conceivably follow the general layout of the Beaufort, perhaps being designed for use on the super 45,000-ton carriers the Navy is constructing.

It is significant to note that many of Germany's bigger planes, including the Heinkel 177 and the Dornier 217E, are fitted with equipment that enables them to be rapidly converted to use as torpedo planes. The Germans may have anticipated the time when every available aircraft would be needed to fight off seaborne invasion, all of which supports the theory that the torpedo plane, land based or carrier borne, is the battleship's most formidable enemy.

Chapter Thirteen

PATROL BOMBERS

THE function of a patrol bomber is to undertake regular reconnaissance, usually over water, looking for hostile shipping, submarines, and aircraft.

The dominating quality of patrol-bomber design is the ability to stay in the air for a considerable period. Flying boats are usually selected for this task, the reason being that they can land on the water if necessary for refueling and servicing. Designed in most cases so that the crew have a clear and uninterrupted view of the sea beneath them, the patrol bomber is usually a high-winged monoplane.

Typical of the best American patrol bombers is the Martin PBM Mariner. The Mariner is a biggish boat weighing some 40,000 pounds with full load and is powered by two 2000-hp. Cyclones

which give it a cruising speed of something over 200 miles per hour. It has retractable wing-tip floats and can be used as a torpedo bomber, carrying its torpedoes under the engine nacelles.

There is little news available of the Mariners in action, but there is no reason to believe that, with its rear turret and forward-firing guns, the Mariner could not be a veritable "Pop-eye," when attacked by enemy aircraft. It carries a sufficient weight of bombs and depth charges to deal with enemy submarines. A descendant of the Martin line of seaplanes, and a cousin of the gigantic Martin Mars, this plane is a worthy example of what's new in patrol bombers. These boats cost a great deal of money and take a long time to build. They are constructed like ocean-going ships and fitted with sleeping bunks, cooking galleys, and everything necessary for the pilots and crew of eleven to live aboard for a considerable time.

The 70-ton Martin Mars is probably the largest patrol bomber in the world. It has a span of 200 feet and is powered by four 2000-hp. Wright Cyclones. It is said to have a range exceeding 6000 miles and ought to be fast. If produced in any numbers, ships of this type would be ideal for the trans-Atlantic submarine patrol, because they would be able to fly from America to Europe and back without refueling. Should their fuel be exhausted, the huge boats could land on the sea, and be refueled from supply ships just as are the Navy's destroyers. Its armament is at present a military secret, but if fitted with adequate numbers of machine guns and cannon, in its six gun positions, the Mars might well live up to its name as a warrior.

In his book, *War Planes of All Nations,* Mr. William Winter, editor of *Air Trails,* states that the flight deck and part of the main deck of the Mars are "pressurized" for comfort on long flights at high altitudes.

In considering the flying boat as a weapon of war, we have to remember that construction of this type of ship is slow. Several Liberty merchant ships could be built in the time taken to assemble this gigantic battleship of the air, so it is unlikely that we shall see much of the Mars during this present conflict. Its great range and carrying capacity would make it an ideal weapon for use in overcoming the vast distances of the Pacific. When we consider that the ship could carry well over a hundred armed troops with light artillery, or probably some eight tons of bombs, it might well present itself as the right ship for use against the Japanese.

Five hundred Mars bombers based in the Aleutians and another five hundred on Midway might carry the war to the enemy. The success of such an action, however, would depend on the protective armor and armament of these huge fellows and their ability to fly at high altitude. As a firm believer in big flying boats and armored battleships of the air, I see in the Mars, the Flying Fortress, and their developments, the warplane of the future.

Typical of good flying boat design is the Navy's PB2Y-3 the Consolidated Coronado, which is literally a flying battleship. What the Coronado has done in this war is as much a secret as the actual details of this super-giant, which is said to have a range of several thousand miles, and ranks as one of the most heavily armed patrol bombers put into service. Equipped with sleeping and living quarters, it has all the necessary comforts for its crew of ten for long flights. Bomb load is probably 4000 pounds.

The Coronado is powered by four 1200-hp. Pratt and Whitney Twin Wasps and has a maximum speed of 230 miles per hour. It is easily identifiable by the twin tail fins which resemble those of the Liberator.

The smaller Consolidated Catalina is the patrol bomber that has earned for itself more honors and glamor than any of the others. It is the oldest ship of its type in service and, as can be seen in the chapter on the Liberator, has one of the most interesting pedigrees, as interesting as its varying exploits which range from dive bombing to submarine strafing and hundreds of sea rescues.

The Catalina, only a year younger than the Boeing Flying Fortress, has been making aerial history since it first flew in 1936. This PBY-5 is some ship. It has a terrific range, a high quotient of reliability, and in spite of its low speed can undertake a variety of jobs. The Navy men who fly "Cats" swear by them, although judging from their slow speed, you would think they were more a handicap than an asset. But there it is, the Cats have fought the Japs and the Nazis. They have sunk submarines, spotted battleships, and shot down fighter planes and enemy patrol bombers. They have dived bombed, and sent torpedoes zooming through the water. They have rescued starving survivors from rafts, and they have carried wounded men to safety.

I actually started writing this chapter in the radio compartment of a Catalina, flying over the Gulf of Mexico. I sat typing away with the plane's captain sitting above me in his queer little turret that is actually the supporting pylon for the huge main wing, set

high above the hull. Later I went forward and climbed in the high seat of the co-pilot. I sat watching the pilot at his massive controls. He smiled at me and pointed to the sea beneath. I saw him put his stick down. It is not really a stick, but rather a stout bar with two wheels attached, running across the entire cockpit. He seemed to be putting his whole weight on it. Down went the nose. We were soon notching up a high speed in the dive, as if we were going down to attack an enemy surface ship.

Down we swooped, almost to the surface, as steep a dive as I could imagine was possible in such a big ship. Then the pilot trimmed the plane and began to pull her out, not the easy job it looked. I saw him strain at the elevator control. Up went the nose, and soon we were climbing furiously with the huge engines roaring lustily. At 4000 feet, he put the big boat into a vertical bank. I looked at the sea down the leading edge of one wing, and at the sky along the other. The bubble in the bank indicator was dead steady. It was a perfect turn, and exceptional piloting. "I thought you would like to see what she could do," said the pilot afterwards. He was as proud of his ship as if it had been a sleek new fighter. "The Catalina is the best ship in service," he said. "We can fight with 'em, bomb with 'em, do anything we're asked."

Certainly the Catalina has all the best features of flying boat design. The bottom of the hull is constructed in a series of three steps rather like those of a racing motor boat. After the last step, the fuselage slims considerably to end in a point under the tail assembly with its high single fin. There is a turret amidships fitted with two .50-caliber guns. Forward from this turret are the crew's quarters, four or eight bunks in a separate bulkhead. Further forward is the radio compartment and navigator's desk. Right in the nose under the pilot is a bomb-aiming compartment and a flexible gun. One of the first things you notice boarding a Catalina is that it is built inside like an ocean-going ship. There are signs everywhere warning the crew not to throw refuse in the bilges, and there is a cooking galley on which one of the eleven crew prepares meals, and everywhere on the flying boat is a truly nautical atmosphere.

The Catalina's wings are set particularly high on a kind of pedestal, where the flight engineer, who is usually the plane captain, sits during flight. From his position he can attend to the engines, oil, and gasoline. Taking off in a Catalina is an experience. The big boats are fitted with taxiing gear, consisting of wheels attached to the hull. As they go down into the water, these wheels are detached,

after the machine has taxied out to the take-off at high speed. If the sea is rough, the spray dashes well over the nose. You have to keep the windows tightly sealed to avoid a ducking. With the tail up, the Catalina begins to buck and jump from wave to wave. Three or four hard jolts and the spray ceases. She is in the air, and climbing rapidly. Landing is neat but noisy. The pilot brings the big ship down in a slow glide. There is a sudden sharp slap as the hull hits the water, and again the see-saw taxiing to shore, with the freshening sea lashing over the bow.

If the ship is to be moored off shore, the sea anchor is dropped, and it really is some anchor. Whenever possible, the planes are taken up the landing chutes. That process is typical of Navy ingenuity and can be a very tough one if the weather is at all rough. As the ship comes in, the landing crew in bathing suits swim out to meet her, bringing with them landing gear which floats because of its inflated tires. These they attach in a matter of minutes. A cable is then attached to the tail, and a tractor on the shore hauls the Catalina to dry land. In summer, the landing crew have a difficult enough job. It takes two or three men to submerge one of the big wheels. They have to hold it under water while another man drives home the bolt to secure the landing gear to the hull. It needs only a medium wave to jerk the buoyant wheel out of the hands of the men who are holding it, and the procedure must be started all over again. Watching this plane crew in the water, I remembered that Cats have been in action in the bitter cold of the Aleutian winter, and off the coasts of England—and posed the question. The answer was that cold or warm, there was only one way of getting a Catalina to shore. Frankly, theirs would be a job I should not like in winter.

The good qualities of the Catalina are found in its range, some 4000 miles at 140 miles per hour, and in its ruggedness. It carries two tons of bombs or depth charges, or two torpedoes. Even though it was not built for combat, this chunky flying boat has acquitted itself as gloriously as that other civilian in uniform, the Lockheed Hudson.

Perhaps the most epic instance of a Catalina's contribution to the greater events of the war was when one of these patrol bombers, cruising the mid-Atlantic, spotted the German battleship *Bismarck* as she was limping home to Brest, France, after her battle with the *Hood*, which had been sunk by a direct hit in her magazines. In spite of heavy antiaircraft fire, the Catalina stalked its

prey and brought the big ships of the British Navy, with escorting destroyers, to send the pride of the Nazi Navy to the bottom.

For the Catalina, this was a routine job. These machines, with their eighteen hours' flying time, are ideal for long, painstaking, patrols, covering square mile after square mile of ocean, cruising slowly to scrutinize every object below—raft, mine, or deserted boat.

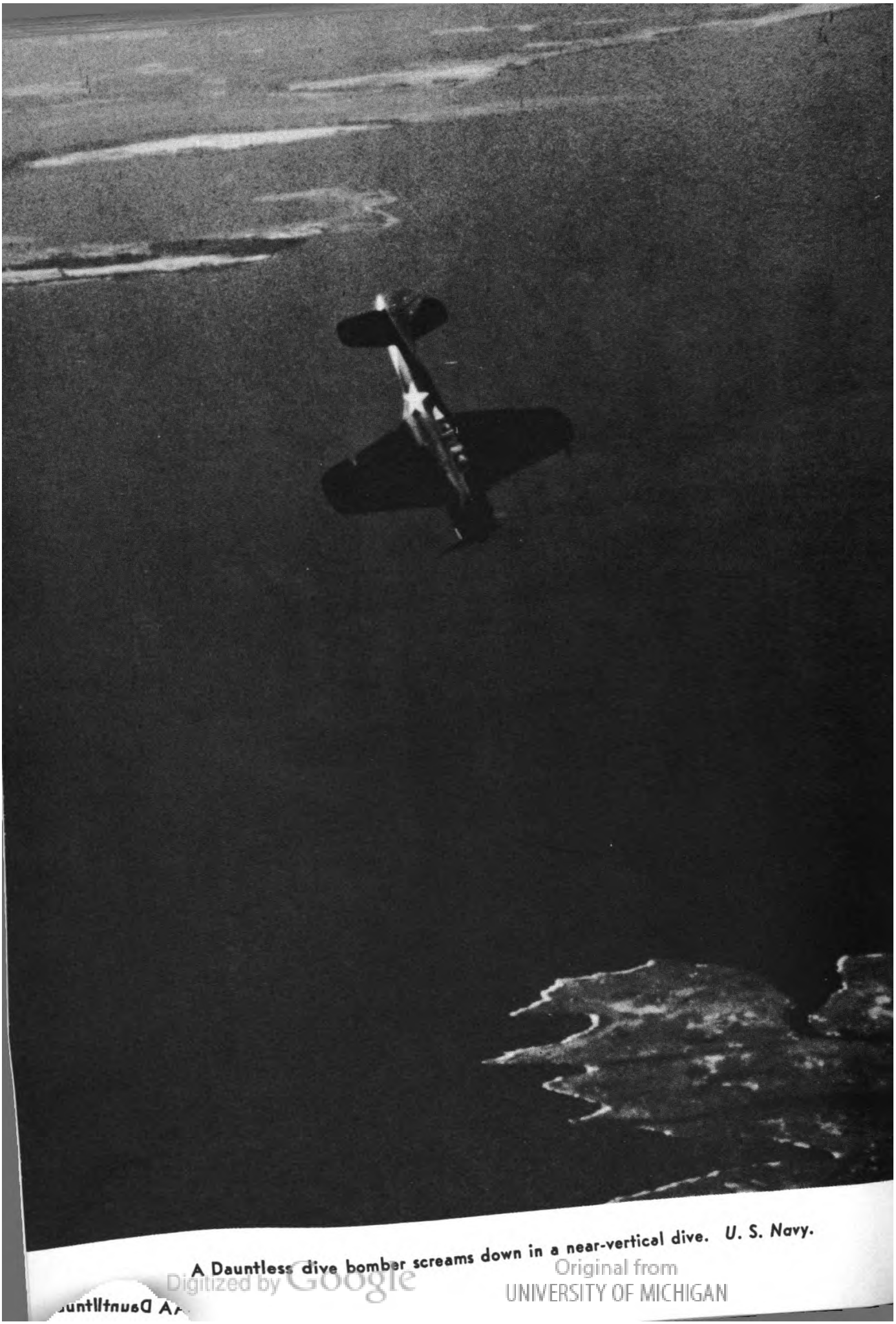
The R.A.F. Coastal Command pilots went enthusiastically "nuts" about the Catalinas. Their unusual flying time proved a boon in coastal defense. After they first went into service, an R.A.F. spokesman asserted that there could not be too many of these remarkable ships. Only one thing was better than a Catalina, said he, and that was another Catalina on the same patrol.

The Catalina has probably sunk more submarines than any other patrol plane. One bombed a submarine from such low altitude that the blast of the bomb blew a hole in the port wing and severed the Cat's fuel and oil lines. The port engine began to burn, and the carbon dioxide fire extinguisher was put out of order. The Catalina crew leaped into action, and the plane captain went out on the wing and succeeded in beating out the fire. Then the plane flew back to its base three hundred miles away on one engine. Thirty-six hours later it was ready for another bombing mission.

A Catalina in the R.A.F. Coastal Command shared the distinction with a Hudson of capturing a U-boat intact. When the Hudson's gas gave out, after accepting the U-boat's surrender, a lone Catalina arrived and held the U-boat captive for eleven hours until the Navy escort vessels took over. Another Catalina crippled a German four-engined reconnaissance bomber so badly that it became easy prey for the Coastal Command's Beaufighters.

One Catalina cruising in West Indian waters found a German submarine surfaced. When the flying boat crept up on them, the sub crew were taken completely by surprise, basking in the sunshine. The pilot of the Catalina, Lieutenant John Edwin Dryden, had sighted the U-boat from eight miles away and immediately glided down to attack. As he swept his heavy boat down, his gunners opened fire from three hundred yards with their .50-caliber guns and plastered the decks of the submarine. One of the crew on the deck collapsed; the others jumped into the sea. Lieutenant (j.g.) Stetson C. Beal, of Lisbon Falls, Maine, the co-pilot, then dropped four depth charges. One of these cracked the U-boat into sections. The center section went under first; then the bow and

SBD-3 Dauntless dive bombers wing over the Atlantic on a scouting mission from their aircraft carrier. ***U. S. Navy.***



A Dauntless dive bomber screams down in a near-vertical dive. *U. S. Navy.*

stern rose in the air and gurgled to the bottom. The crew in the circling Catalina watched the huge oil slick spreading to mark the grave of the undersea raider. They saw eleven blackened, grease-covered bodies swimming in the oily scum. The Cat dipped low, and the work of rescue began. The Americans dropped life rafts, life jackets, and emergency rations. Six of the Germans failed to cling onto the wreckage; five finally clambered on board one of the rafts. They began waving frantically, appealing to the plane to land, but the sea was too rough, so the Catalina returned to its base, later to dispatch a rescue vessel.

The list of Catalina rescues reads like the logbook of a Coast Guard rescue boat. Hundreds of shipwrecked sailors owe their lives to pilots and crews of these patrol bombers. On one occasion, a Cat pilot spotted seventeen survivors of a torpedoed vessel, drifting on a raft. They had been without food or water for sixty hours in the sun and were so exhausted that they could not reach the provisions and first-aid kit dropped near by. The pilot decided, therefore, to land, although the sea was very rough. He loaded all the survivors into his plane, and took off in the face of a swift gale. Neither he nor the crew expected to make the take-off. Once a wave nearly capsized them, striking its full force on the port wing. But the sturdy ship shook itself free and careened on for another mile or so across the ocean. Finally they left the surface and staggered homeward with a load so heavy that experienced Catalina pilots gasp at the story.

One of the most daring Catalina actions was the prelude to the Battle of Midway. The Catalinas spotted a huge Jap armada heading toward the island and reported its progress hour by hour. When night fell, four Cats, loaded with deadly torpedoes, made an attack by moonlight and scored the first blow against Japanese sea power in that historic engagement.

Outstanding and incredible was the work of a Catalina squadron in the Aleutians when the Japanese made their attack on Kiska. These Catalina pilots are considered supermen even by the most experienced of their colleagues. Aleutian weather is never a picnic. It is a mixture of rain, fog, snow, hail, and everything except clear weather. The Catalinas kept constant watch over the straggled islands, flying hour after hour, landing in secluded bays to wait for their mother-ship to come and refuel them. They had no fixed base, and few repair facilities. It was a Catalina that first gave warning of the approach of a Japanese invading armada in these waters,

including an aircraft carrier and escorting vessels. This Cat was attacked by Zeros and severely damaged. The pilot dropped his bombs and scored a near miss on one of the warships, fought off the Zeros, and managed to return to his base.

From that moment, the Catalinas kept up a constant running fight with the enemy. They dropped torpedoes, depth charges, and even dive bombed the Jap-held harbor of Kiska. Often they flew until their tanks ran dry and then landed on the sea as near as possible to their tender. There was no eight-hour day for these crews. Some of them flew for sixteen hours, fulfilling missions such as strafing Jap landings, bombing supply dumps, and slipping torpedoes into the sides of the Jap supply ships. One pilot flew nineteen hours out of twenty-four on milk-run bombing trips to Kiska. Another piled up 178 hours of combat in less than three weeks. The pilots called their outfit the "PBY Interceptor Command" and grimly named Dutch Harbor the "PBY Elimination Base."

In combat with Jap Zeros and seaplanes, the Catalinas proved their ruggedness. One was hit several times while in combat with two Zeros, one of which the turret gunners shot down. The other continued to attack. Jap shells severed the rudder cables, leaving the Cat pilot only the aileron and elevators for control. He put his machine into a ninety-degree turn with ailerons alone, shook off the Zero, and climbed to the safety of a cloud bank, where he "sat" cruising and waiting for the other Zeros to give up the chase. Luck was against him. The wings began to ice, and he was forced to go down again. He went into a steep dive, unseen by the Zeros, but when he finally leveled off, the gas was exhausted. He landed on the sea and was found by another Catalina.

Dive bombing in a Catalina was rather a test of physical strength for the pilot and co-pilot. The Catalina captains made a habit of cruising in the overcast toward their objective, and then diving suddenly through a hole in the clouds, at a speed exceeding 300 miles per hour. To get the nose down meant two men pushing and holding down the control stick with all their strength.

To pull out was always an adventure. The Cats weigh something over 27,000 pounds loaded, and 27,000 pounds traveling downward at 300 miles an hour represents a fantastic weight, which you can calculate for yourself with the assistance of a physics or mathematics expert. But to the Catalina men this desperate proceeding meant another job in the line of duty. Working in unison, the pilot and co-pilot braced their feet against the rudder bars, wrapped

their forearms round that hefty control column running the width of the cockpit, and pulled, "while," as one pilot put it, "the plane captain prayed."

The big boats always came out; sometimes they shuddered and staggered, their big wings flapping like those of a seagull. "Wing flutter." A young Catalina pilot laughed. "You haven't seen nothin' till you see those Cat wings wobble. But they never come off. At least mine never did." How the Catalinas hung together is just the secret of these wonderful boats. One Catalina pilot who had been dive bombing in the Pacific told me a "fish" story. At least, it seemed that, but judging from some of the Catalina feats, it may be true.

He and his crew spotted a Jap destroyer. They went down to attack, and scored a near hit. The destroyer was putting up a heavy flak barrage, but the Cat's crew decided to attack again. The big machine circled like a fighter, while the gunners swiped the destroyer's deck with .50-caliber machine-gun fire. Then the pilot went up and made another dive. As he went in, a Jap shell passed clean through the cabin without exploding and temporarily blinded the pilot. The bombardier let go his bombs, but the pilot could not pull out. The crew in the bulkheads heard a crash. A gaping hole appeared in the port hull near the bilge; then a wicked slapping, crashing noise, and the crewmen were thrown off their feet. It meant only one thing—the Cat had hit the water, and the end. But it was only the beginning—of the home flight. This Catalina had scraped off the destroyer's radio mast, slicing a hole in its own hull. Then it had hit the water, bounced into the air, and continued flying. Fish story? Well, it is a good "Cat" story, and the man who told me assured me solemnly that it was true.

Air battles in which Cats have downed enemy planes are legion. One Catalina crew shot down four Zeros, damaged a huge Japanese four-engined seaplane, and knocked out a submarine, all in one twelve-hour flying trip. The pilot brought some of his crew back dead, but they had won a series of glorious victories.

Catalinas seem to have been in action on every battlefront. They played a large part in General MacArthur's air offensive against Jap-held territory in the South Pacific. A squadron of Cats flew from Darwin, Australia, to Babo, in Dutch New Guinea, and blasted port facilities and an enemy airfield. They destroyed twenty-three aircraft on the ground and started a fire that could be seen eighty miles away. All returned safely, in spite of heavy anti-

aircraft fire and night fighters, one of which was shot down. Said one of the pilots who was decorated for heroism in this action: "The Catalina deserves the decoration."

When the first Catalinas flew to England to work in R.A.F. Coastal Command, they went to the relief of a very gallant old lady who had been hurriedly put into uniform, although originally destined to carry passengers to the four corners of the earth. This was the R.A.F. Short Sunderland, a huge 23-ton, four-engined flying boat powered by four 1000-hp. Bristol Taurus engines, capable of a range of 3000 miles under certain conditions.

The Sunderland is a story in herself. Built like a ship by the firm of Short Brothers of Rochester, Kent, by men who originally built pleasure yachts, her brother is the Short Stirling, and her ancestors a long line of float planes and flying boats.

The Sunderland's family really began in 1923, when Short's began to build flying boats for the R.A.F. The performance of these ships was so universally outstanding that the British airlines, under government supervision, decided to use them for the proposed Empire air route from England to Australia. Horace Short, designer of the Sunderland, had a novel idea for producing his aircraft. He first built a flying mock-up complete to the last detail, then tested it out, making modifications on the mock-up rather than waiting until the full-sized version was completed. In the construction of flying boats, this procedure had many advantages. You could build a perfect ship in miniature and thus avoid delays in production, which is necessarily lengthy. As a result of tests of the little boat, which I witnessed, the first full-size model came out in perfect shape. Its test flight at Rochester was a sensation.

Imperial Airways ordered five of the big ships immediately, but few of them saw passenger service. One of them, named *Clare*, made a flight to New York under R.A.F. insignia; others ran on the Empire route to Sidney, via India, while the rest went into service of the Coastal Command as patrol bombers and sea-rescue ships, undertaking a variety of wartime missions, including the all-important task of maintaining communications between London and her outlying outposts.

In itself, the Sunderland was the basic design for the battleship of the air. At the beginning of the war, it was probably the most heavily armed bomber in action. Its crew of eight or ten, according to the mission at hand, had at least eight guns available for defense.

Four were mounted "Chicago-piano" style in the tail, two in the nose, and the others in turret and slit-holes along the fuselage.

The interior of the Sunderland is vast. There are two decks inside the big hull. Setting off in one, during the early days of this war, I had the impression of riding in a flying ship. The pilot's cockpit resembles the average New York one-room apartment, and the rest of the plane is proportionately roomy. We took off after what seemed a comparatively short run for so big a ship, and flew through bumpy weather as smoothly as if we had been running on invisible rails. Looking down at the sea, and contemplating our escort of Hudsons, I remembered with a quiet thrill that this actually was a flying ship. It had been born in a shipyard and launched like a ship. I walked aft to observe the rear view through the turret. It was a long walk, vibrationless and noiseless. There were ladders leading to the top deck and to the turrets. There were a mass of radio gear, and bunks for the crew. The rear edge of the great rudder seemed to soar upward like a skyscraper.

I made a note at the time of the impression I had of tremendous and unassailable security. It would take more than a single fighter or antiaircraft burst to down this graceful monster, now batting out to sea at some 200 miles per hour, slow as planes go, but strangely satisfying.

I have thought often of my flight in that Sunderland as details come over the wires of the astonishing feats being notched up by these planes. Not for nothing did the German pilots name them the "Flying Porcupines." The war was two years old before the Heinkels and Messerschmitts could register their first victories over these flying boats with their deadly component of guns. The first news of a Sunderland's victory over German fighters was a prelude to the German campaign for Norway. A Coastal Command Sunderland was snooping along the Norwegian coast, when two Heinkel float planes swooped on it. The first burst from the leading Heinkel killed the Sunderland co-pilot. The Sunderland nose gunner got the Heinkel, which curled away to the sea below with smoke pouring from its engines. The second Heinkel dived underneath them, aiming to come up under the wing and shoot up the port engines. A blast from the Sunderland's rear turret cut short his intentions, and the huge plane continued its patrol.

Suddenly out of a cloud formation leaped three Me-109's. There followed one of the most extraordinary battles in Coastal Com-

mand records. The Sunderland captain determined to give fight. He maneuvered his ship into a tight turn and as she was standing on one wing tip, the gunners shot it out with the German fighters. One of the Me's dived headlong at the Sunderland. A burst from Sunderland gunners probably killed the pilot. The machine was coming on at full speed, and the Sunderland's turret gunner ducked, convinced that the German would ram them in its death dive. Luck was with them, however. The Messerschmitt missed by a few feet and continued its screaming passage down to the sea.

The other two Germans then delivered a dive attack. Their bullets ripped into the tough stressed-steel skin of the Sunderland. An incendiary bullet started a fire, which the radio man beat out. The tail gunner gave a shout. By what seemed miraculous shooting, he had winged one of the attackers. A burst from his four guns had clipped the wing right off the Messerschmitt, and the pilot was floating away in his parachute. The other Messerschmitt made for home, and the Sunderland continued its patrol.

After that, German fighters were respectful of the "Flying Porcupine." Nazi float planes in particular met with disaster in their encounters with Sunderlands. One epic, of which we have little detail, was a battle between a Sunderland and a Focke-Wulf Kurier. The German plane, although much faster than the British ship, came off the worse, and the Sunderland returned to its base only after giving up the battle because of ammunition shortage.

In the Bay of Biscay, where it was searching for U-boats, a Sunderland encountered eight Ju-88 fighter-bombers. Their desperate need for long-range fighters caused the Germans to convert a number of these planes for the specific use of shooting down British communication and sub-strafing planes. The Ju-88's came roaring down on the Sunderland, their front guns spitting fire. After this first attack, the Sunderland's Australian crew were in bad shape. The rear gunner had been killed, four others were wounded, and the plane was burning in several places. "Tally ho, Digger!" cried the flight sergeant from the top turret. "Give those —— all we have! Come on, Diggers." It was a battle cry.

Without waiting to look over their wounds, the Australian gunners went to work. Fifteen minutes later, the battle was still raging, but three of the Junkers fighters were floating on the surface of the sea like dying moths. The captain of the Sunderland was wounded. A crew member patched him up, as he sat at the controls. Interphones had been shot away, an ammunition chute had been

damaged, and everywhere were blood and smoke. For ten more minutes, the R.A.F. battleship fought on. In that ten minutes, four more of the Ju's were damaged. One by one they went scuttling into the clouds, with smoke coming from their engines. "If they got back," said a Sunderland gunner later, "I guess the Gremlins were on their side." A few minutes later, the last of the German planes made an attack. He was met by a series of bursts of fire, his own bullets went wide. He turned and flew away.

The Sunderland flew back three hundred miles to Britain, so badly holed that it had to be beached, but as a British aviation magazine put it, "It had been a glorious victory."

Victories over subs are all in the Sunderland's line of duty. They have sunk supply ships with their bombs, strafed enemy E-boats, and attacked submarine tenders under the very noses of German fighters. The huge load capacity of the Sunderland and its ability to land on the sea even in rough weather make it ideal for rescue work. During the evacuation of Norway, hundreds of soldiers and civilians flew to safety in these big boats. In Greece, when Nazi armies were furiously trying to push the British into the sea, a squadron of Sunderlands, some of which were just newly arrived from England, worked day and night taking off valuable lives. They flew to their landing through antiaircraft fire and attacking fighters.

One of these Sunderlands survived a dive bombing by Stukas. The pilot kept his machine snaking over the surface of the water, as the bombs fell, and the gunners blasted away at the Stukas. Hour by hour, loaded to the gunwales with troops, the big flying ships plied their ferry service back to the North African mainland. The Sunderland's service in the evacuation of Greece should have been a lesson to the Germans. It demonstrated that a good flying boat skillfully handled can be of inestimable service. In view of the pathetic attempts of the Germans to evacuate their troops from Tunisia, it seems they did not profit by this example.

Sunderland crews live aboard their two-decker ships and are accustomed to twelve or more hours' flying during their patrols. They escort convoys, hunt subs, and search the sea for survivors of torpedoed ships. One Sunderland belonging to an Australian squadron spotted something bobbing up and down in a choppy sea. The pilot flew down and found an open raft huddled with the survivors of a torpedoed vessel. The men were exhausted. One managed to wave his hand, but the others were flat out. There were twenty-one

on the raft. The pilot decided to land, a perilous business on such a rough sea. He brought the machine down safely, however, and turned its nose into the wind, while the crew launched the dinghy. One by one, the exhausted men were brought aboard.

The Sunderland took off, those crew members who could be spared from their posts ministering to the unhappy survivors. Most of them were too weak to speak. Suddenly the co-pilot gave a shout of warning. On the sea beneath was the unmistakable feather of a submarine periscope. A Nazi sea raider was cruising just below the surface.

The Sunderland pilot dived his ship and released four bombs round the trailing feather. They exploded beneath the water, throwing up great plumes of spray. The Sunderland circled, preparing to dive in and attack again. As the nose went down, the U-boat slowly rose to the surface, swaying and pitching. Four more bombs were released, two of them direct hits. Onto the deck poured men from the conning tower, as the shattered sub sank under their feet. Reporting back to his base, the young Australian captain remarked that they had had "a good day."

All things considered, the United Nations owe a great deal to the Catalina and the Sunderland. Certainly, the Nazi U-boat commanders hate and fear them.

Chapter Fourteen

RUSSIAN BOMBERS

CONSIDERABLE mystery still surrounds the Russian Air Force, particularly as to types of machines in action, and the number of planes of various types available. The Russians somehow or other managed to convince the European powers that in spite of the general air-mindedness of the people, their planes were not up to the same standards as those of England, Germany and the United States. Mr. Charles Lindbergh, who visited Russia on the same trip

during which Goering and Milch sold him a bill of goods on the Luftwaffe, came back to America with little to say about the Red Air Force, other than the implication that it was inferior.

At the beginning of the war between the Germans and the Russians, the Red Air Force was known to have a considerable number of old two-engined bombers closely resembling the old French Farman type, but there was little news of anything in the heavy class, and the war progressed without any reports of long-range bombing attacks against German centers. In 1942 the Russians sprang a surprise on the British and Americans when they sent Premier Molotov to England and to the United States in a huge four-motored bomber, typed the TB-7, which dwarfed our own Fortress in size, if not in speed. The TB-7 was indeed a closely guarded secret, and on examination revealed many interesting features, especially in the number of guns carried and the position of two firing places in the wings and firing to the rear by remote control.

The TB-7 has a span of 120 feet, weighs over 50,000 pounds loaded, and is powered by four liquid-cooled engines of 1300 hp. One radiator serves as a coolant for each pair of engines. The machine is heavily armored, and carries a bomb load in the neighborhood of 8000 pounds. These machines may have been used in the Russian raids on Berlin during 1942, but no details have been given, other than correspondents' reports that machines of "a secret type" were employed on these attacks on the German capital.

How many of these bombers Russia has, whether she has continued to manufacture them, time alone will prove, but if she has been able to continue production and is holding them for an all-out blitz on Germany to hew a path for her advancing armies, they will prove a considerable asset to her air power.

The TB-7 is a development of the TB-6, a machine of similar dimensions which had five engines, one installed in the fuselage to drive the supercharger for the four engines mounted in the wings. The power units of this machine are 830-hp. Hispano-Suiza engines, which give it a maximum speed of 210 miles per hour at 25,000 feet. The TB-6 was used by the Russian aviator Levensky in his attempt to fly from Moscow to the United States across the North Pole. Its bomb load is around 6000 pounds and it can be readily adapted as a troop and cargo carrier.

The Russians have made good use of tactical bombing and ground support of their advancing (or retreating) armies with medium bombers and fighter-bombers. Their standard medium

bomber, the DB-3F, is a small two-engined plane with a maximum speed of 265 miles per hour and adaptable for use as a dive bomber or attack plane, or night interceptor. The DB-3F carries a crew of three or four according to the mission, and is easily recognizable by its long nose with the top filled in with glass panels. The machine can be used for a variety of jobs, ranging from short missions with a 5000-pound bomb load to 2000-mile round trips with 2000-pounds of explosives. It also serves for high-altitude reconnaissance and photography and is a development of the DB-3 which had a gun turret in the nose, a feature that has been dispensed with in the later model.

The TB-1 is a ponderous-looking, low-winged monoplane with square wing tips, powered by 680-hp. BMW engines. These machines seem to have been produced in large numbers previous to the outbreak of war between England and Germany in 1939, as was the big four-engined TB-3, a massive low-winged monoplane of the same shape as the TB-1, but with a comparatively low speed for its size. The TB-3 was used extensively for carrying paratroopers, and its use before the war probably gave foreign observers the impression that the Russian Air Force was obsolete and useless.

Neatest and most efficient of all the Russian bombers is the PE-2, an attack bomber with a high turn of speed and a degree of maneuverability that suits itself admirably to Russian practice of using bombers to fight bombers. The PE-2 has twin tails and two 1300-hp. engines. At first sight it is similar to the Me-110, but according to experts it is a better designed and more formidable plane. Russian correspondents in reporting the downing of German bombers by Russian attack planes probably refer to the PE-2, although details of machine performance are sparse.

The PE-2 in many respects resembles the British Mosquito, but it is larger than the British bomber, and also larger than the YAK-4 and the P-2. It has an outstandingly long nose with a raised cockpit cover where the crew of three or four are housed. The machine is of all-metal construction, with flush riveted stress-skinned covering on the wings, and fabric-covered control surfaces.

The PE-2 is well armed, with two machine guns mounted in the nose, others in the rear of the cockpit, and two set to the rear of the cockpit firing downwards fore and aft through the floor to the rear of the bomb bay. Some models have additional armament for

night interception; others have fixed cannon guns in the nose for ground strafing.

The PE-2 has gained for itself quite a reputation as a fighter. It fits in admirably with the Russian conception that anything that flies should be used to fight the Germans. One Russian pilot in a PE-2 tangled with three Nazi bombers, type not mentioned. He shot down one, damaged the second, and cheered on by his score rammed the third, afterwards succeeding in making a crash landing. That the PE-2's are able to look after themselves is shown by another report that four PE-2 squadrons made ten raids against German positions without a single loss, shooting down twelve German fighter planes.

The most outstanding production of the Russian Air Force during this war is the Stormovik dive bomber which first showed the Allies and the Germans that the airplane could be used as an answer to the tank. The Stormovik, designed for close co-operation with infantry, carries a rocket bomb under the fuselage, and is armed with a 32-mm. cannon in each wing and several machine guns all firing outside the propeller arc. The heavy punch carried, however, is the rocket bomb. The Stormovik is a one-man machine, the pilot having an ample supply of guns and a wealth of armor to protect him during his low-flying attacks. Stormovik tactics are to swoop down rather than dive on advancing enemy tanks, sight the machine like a gun, at the same time using the armor-piercing cannon projectiles, and release the bomb. Operated as the bomb leaves its cradle underneath the fuselage, the charge is detonated, and the missile acquires a formidable velocity, which reaches its peak at the moment of impact with its target. So successful was the Stormovik during the German offensives of 1942–43, that the German tankmen called it "The Flying Death." A British observer who saw a squadron of Stormoviks in action related that twelve machines disabled fifteen tanks in a single attack. The Stormovik is heavily armored as a defense against fire from the ground.

Another medium bomber also used as a day and night fighter is the YAK-4. The YAK is built of wood and metal, and is used both as a single-seater and with a crew of two. It is powered by two 1100-hp. engines and packs three guns, with the rear-firing ones probably operated by remote control. The YAK operates as a dive bomber and attack plane and was designed by Alexander Yakovlev, one of Russia's leading designers.

Generally speaking, Russian machines confirm to the Russian viewpoint on military aviation, which is purely realistic, and considers airplanes as an essential part of land armies. Russian aviators are under control of army generals and are mainly employed in short-range operations. For that reason the Russians have developed the medium bomber and the fighter-bomber in preference to the heavy long-distance craft. The Red Air Force seems to have the fewest machine types of all the belligerents, but its performance in action seems to have justified this economy in manufacture and pilot training.

Chapter Fifteen

AXIS BOMBERS

THE outstanding difference between Germany's bomber force and that of the United Nations is that while we have a variety of bombers, one for every purpose from dropping block busters to precision assault with light, fast, dive bombers and fighter-bombers, the Germans have concentrated on short-range aircraft. Standardization to facilitate mass production seems to have been the watchword in the creation of the Reich's air power under the guidance of Udet and Goering, both World War I fliers.

As with other nations, the type and performance of Germany's aircraft have been governed by the geography of the country. Germany decided early in the 1930's that she would use her air arm to deal heavy blows to neighboring countries, and so she developed the medium bomber above all other types.

In 1932, Goering was appointed commissioner in charge of German aviation. The plump dreamer immediately went to work to build himself first of all a large Air Ministry building, which later provided an excellent target for the bombs of British Mosquitoes. He then organized numerous factories and training schools. The factories were mostly in the eastern part of Germany, as far as pos-

sible from the French frontiers, and the training schools were near by. At that time the Nazis would never have considered Russia a probable enemy.

These factories were models of what war production plants should be. They were large, exceedingly well camouflaged, and surrounded by housing projects, where the workers lived under ideal conditions. Each factory had its own school for the workers' children.

The Luftwaffe grew quickly. In 1935, twenty-four squadrons of bombers were in service, and in 1937 the He-111 and the Me-109 went into mass production. Goering seems to have decided to build these two planes as the backbone of his Luftwaffe.

The Heinkel 111, which was designed before the British Blenheim, was undoubtedly the best machine of its type in the world at the time. It was faster than the fastest British fighter, the Hawker Fury, and it carried a hefty bomb load for its size. This machine, however, can really be blamed for the shortcomings of the other Nazi bombers at the opening of the war. Since there was nothing to equal it for bomb load and speed, Goering probably imagined his fast bombers would leave the British fighter planes standing, flash in to drop their bombs, and make good their escape. A fine machine aerodynamically, the Heinkel 111 was soon to show itself as the possessor of many serious defects as a military weapon.

The R.A.F. soon found it was as easy a plane to shoot down as the Stuka. After the first few months of air war, when the Heinkel pilots spent a lot of time flying in the clouds to which they had run on seeing British fighters approach, these planes were withdrawn and replaced by the Dornier 17's and Junkers 88's, and by the Messerschmitt 110 fighter-bombers.

The only novelty the Nazis produced, and, as we have seen, it was really no novelty, was the Stuka dive bomber. The Stuka was used with great effect in Poland, Norway, and France, and when the fall of France brought the Germans face to face with the problem of smashing England to submission, they relied almost entirely on the medium bombers. These were the Junkers 87 and 88, twin-motored utility bombers, with the Dornier 215 and Dornier 17 (known as the "Flying Pencil") and several types of the fast Heinkel 103.

The Stuka, or Ju-87B, which derives its name from the German word *Sturzkampfflugzeug*, is about the ugliest, meanest-looking

aircraft that ever flew. It does an ugly job and has some ugly crimes against civilization and humanity to its record. This aircraft made its first appearance as a civilian plane, when sold to Sweden and powered by a Bristol Jupiter engine. Its prototype, the Ju-87A, made its first appearance toward the end of the Spanish War, when the Nazis sent aerial help to Fascist General Franco. At the beginning of this war it appeared in large numbers and blasted the invasion path for German tanks and mechanized infantry through Poland, the Low Countries, France, and Greece.

With its whistles and sirens to increase the noise of the dive and create consternation below, the Stuka was a most horrible and formidable weapon of war. Its bite was bad, too, and the aim of its pilots excellent, but good tactics by the R.A.F. fighter pilots soon exposed its weaknesses.

Goering let loose his Stukas against Britain, but they proved so vulnerable that after the first few dreadful days when the R.A.F. Spitfires, Hurricanes, and Defiants blasted the Stukas at will, Goering withdrew them. That does not say that the Stuka was not a good plane at the job for which it was intended. It was, in fact, astonishingly efficient at blasting artillery positions and at hacking an explosion-blasted path through inhabited areas.

The main defect of the Stuka was its lack of defensive armor and armament, allied with its slow speed. The machine was designed for dive bombing. Equipped with dive brakes, and with a specially designed bomb rack, it was meant to dive on ground positions at 200 miles per hour and drop either a 1000-pound or two 500-pound bombs. It was mass produced to fit in with the German conception of aerial blitz, swift and ruthless saturation of the target area, to be followed by the advance of the mechanized armies. Such refinements as retractable landing gear were omitted.

The Stuka has square-tipped wings, a square tail plane, and an ugly-looking nose, the air vent of the 1200-hp. Jumo liquid-cooled motor giving it the look of having a double chin. Little thought was given by the designers to defensive tactics. In the oblong "greenhouse" behind the pilot sits the radio operator–gunner. His weapon is a small caliber flexible gun. Firing forward are two fixed guns on the wings. With such armament, and comparatively slow speed, the Stuka was a sitting duck for British and French fighter planes. Nazi air generals must have known this when they ordered mass production of their flying death trap, but pilot and gunner lives were not considered in the ruthless Nazi war plans. Working

in co-operation with the Panzer divisions, for which they were to serve as artillery, the Stukas were invincible and fulfilled the basic idea behind their construction—"bomb-dropping flying machine."

Flying such an aircraft in the face of antiaircraft fire from the ground calls for cold courage and steady nerves. To be in an area attacked by Stukas is a terrifying experience. The first time I saw one of these black ugly planes I thought it was a machine which had been hit and was diving to destruction. I lay flat on the ground, on the South Coast of England, and watched what I thought was going to be a crash. Suddenly a black object fell from the machine. I was still convinced that this was a crash, but the plane pulled out, and was soaring away as the big bomb exploded on the ground. Its life was short, however, for a pair of Hurricanes appeared from nowhere and opened fire on the rear of the dive bomber. They seemed to fire at long range, but as they broke away under the Stuka's tail, it burst into flames and rolled over and over into the English Channel.

Subsequently I watched other Stuka attacks, all delivered with the same precision and daring. Losses to the dive bombers were astonishingly high. Some succumbed to antiaircraft fire from the ground; others were shot down by interceptors. Intercepted on their way to the target, on one occasion, an entire formation of Stukas jettisoned their bombs and turned tail, with a section of Spitfires after them.

In the North African campaign the Stukas were completely eclipsed by the variety of planes the American and British air forces used against them. The Curtiss Warhawks and Tomahawks terrorized them. Bostons, Bisleys, and Blenheims shot them down at will, and combined to put an end to an infamous career.

The vulnerability of their machines was a crushing blow to Stuka pilots, many of whom waited on the ground to surrender, rather than take to the air. An R.A.F. wing commander, who was among a party of British and American troops taking over an Axis airfield, said that when a Hurricane squadron destroyed half the strength of the Stuka squadron based at that field, the remaining Stuka pilots declined to fly.

Colonel John C. Smith, commander of a United States antiaircraft battery whose unit destroyed seventy-eight Stukas definitely, with the possibility of many more, described the Stukas as being "all done," on his return to Washington. "Our antiaircraft scared them," related the colonel. "We got one right on the landing barge,

and ten more on the shore while we were covering the landing of infantry and artillery."

Later, in three hours of fighting, one battery knocked down eleven Stukas out of twenty. In another encounter, thirty-three Stukas attacked, but only twenty were seen to continue flight after dropping their bombs.

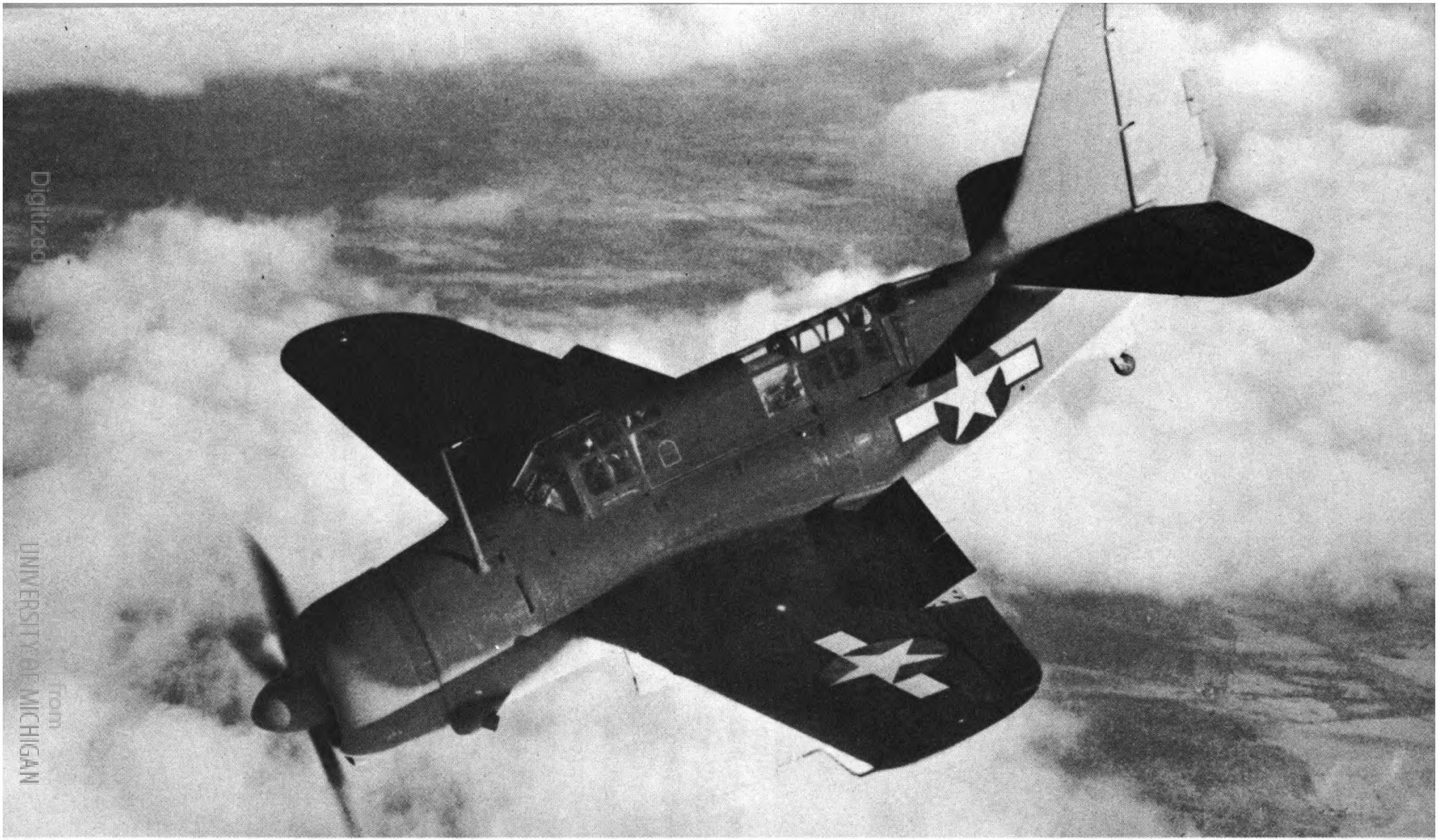
We owe a great debt to the Stuka, however. Its initial successes demonstrated the efficacy of dive bombing. Its shocking vulnerability showed us that dive bombers need to be tough enough to look after themselves. Similarly, the mass losses of the Stukas probably gave the R.A.F. the cue to develop their fighter-bombers and low-flying attack squadrons.

A study of German bombers at the outbreak of war gives us a clue to the German idea of mass production and standardization, which led to its present plight. Using the words of General "Hap" Arnold, this plight is one of mathematics, that of dividing a given force of bombers between two fronts, and halting bomber production to increase the number of fighter planes for a defensive aerial war. Luftwaffe bombers in the Battle of Britain were the Junkers 88, the Dornier 15 and 17, and the Heinkel 111, later to be assisted by the Me-110 fighter-bomber used for fast daylight raids at low altitude.

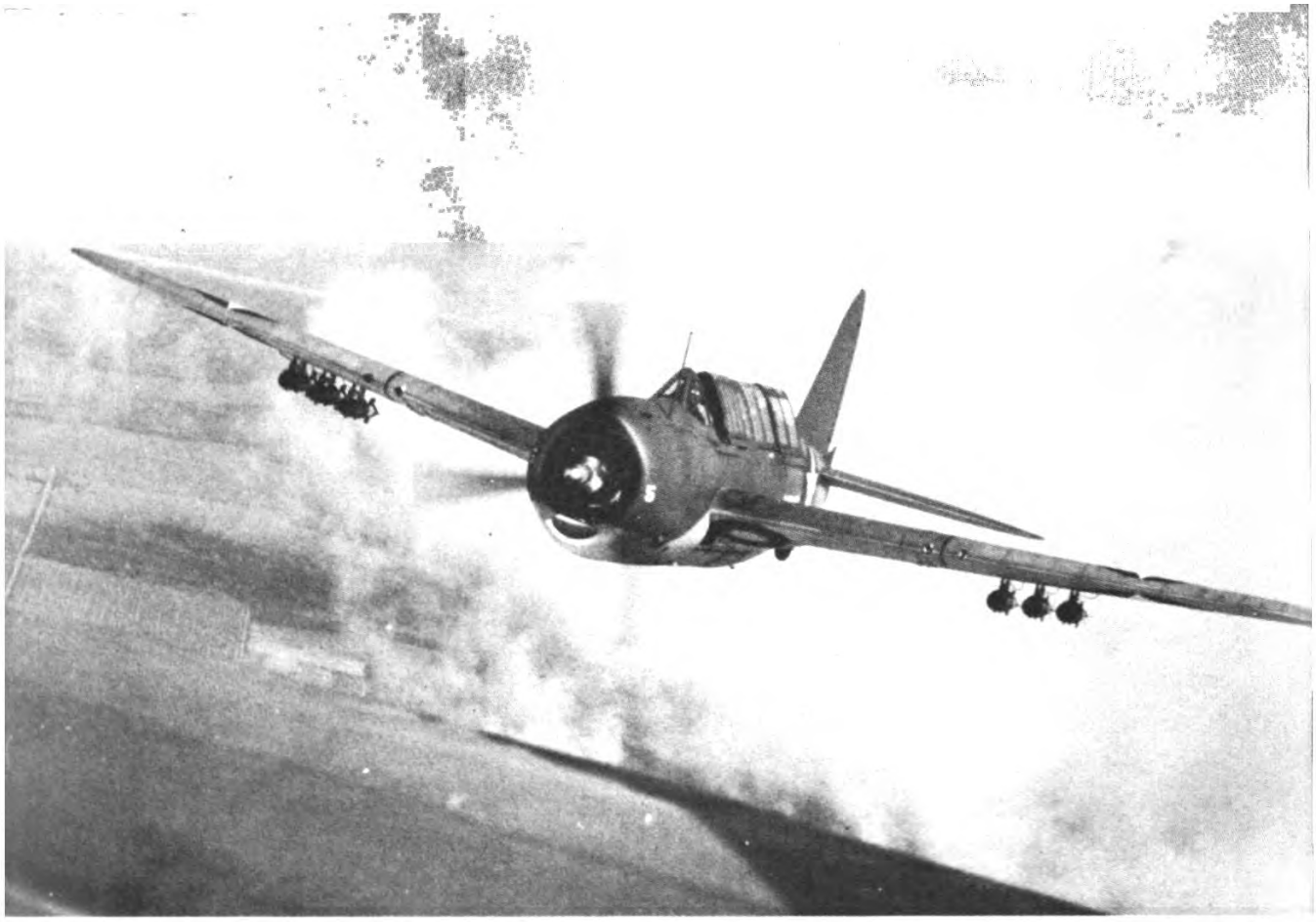
The principle behind the selection and production of these types seems to have been universal, good all-round performance, with adaptability to medium bombing by day and by night, dive bombing, mine laying, and torpedo work, as well as reconnaissance, night interception, and low-flying attack.

German bomber design differs from British and American in one respect. The Germans like to group their crew together in the middle of the machine and do not use rear or tail turrets. Their bombers were not heavily armed, and no attempt was made to produce a heavily gunned ship such as the Fortress or Stirling.

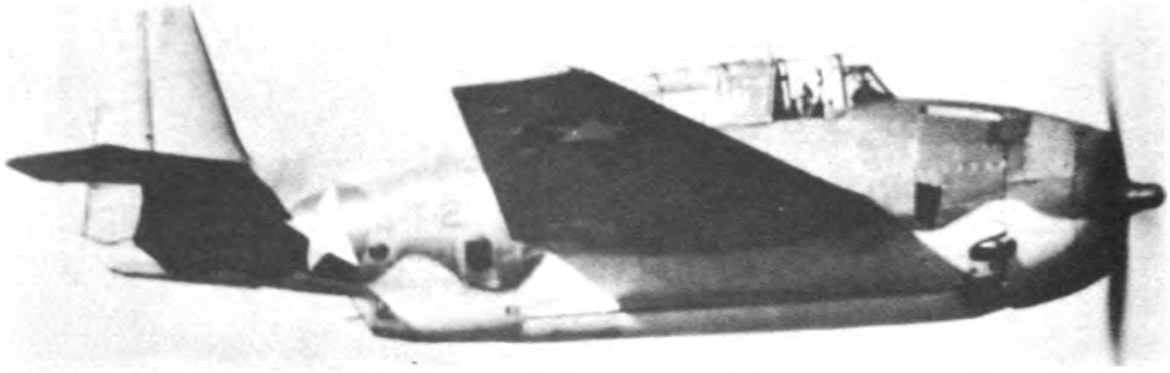
In planning their aerial offensive, Goering and Udet worked on the assumption that protecting screens of German fighter planes would always be able to escort the bombers to their targets. In putting this principle into operation, Goering failed to consider the possibility that British fighters might ignore the Messerschmitt and Heinkel escorts and attack the bombers direct, which is exactly what the R.A.F. did, with disastrous results for the Luftwaffe. Had Goering employed the strategy of sending extensive fighter plane sweeps over England a month before attempting his all-out bombardment assault,



The SB2C-1 Helldiver that is now being built for the Army, Navy, and Marines.
Curtiss-Wright Corp.



(Above) An SB2A Buccaneer dive bomber, with the enemy objective sighted, ready to peel off in its dive. *Brewster Aeronautical Corp.* (Below) A TBF Avenger torpedo bomber cuts loose its cargo. *U. S. Navy—Acme.*



the Swastika might now be flying over London. The German aerial attack on Britain was an outstanding example of overanxiety to deliver the first punch, and the reckless waste of men and machines.

Failure of the German bomber types used was due to the superior fire power of the R.A.F., the inability of Luftwaffe fighters to protect them, and the vulnerability of the bombers themselves, many of which had little or no armor, and small chance of defending themselves. They were all, with the exception of the Stuka, astonishingly good airplanes, well constructed, adequately powered, and fast for their size and bomb load.

The Junkers 88 is a typical utility design. It was probably the best of all-round airplanes in its day. Powered by two 1150-hp. Jumo engines, and carrying a crew of four concentrated in the front of the plane, it has a speed of 255 miles an hour with a 4000-pound bomb load. Fitted with dive brakes, it is the heaviest and most formidable dive bomber, and with the modification of a concentration of machine guns in the nose, it became the Luftwaffe's best night interceptor. Its range of some 1500 miles made it ideal for the task of prowling night skies.

Normal armament of this all-purpose ship is about six guns and one 20-mm. cannon. The gunners are all grouped around the pilot, and the man who operates the nose gun or cannon seems to lie fully extended in a specially armored protuberance underneath the nose. The Ju-88's used in the Battle of Britain were lightly armed, with only three flexible machine guns, one in the nose and one back of the pilot's seat, with one in the blister below. The R.A.F. attributed to it a speed of 315 miles per hour, which is a very nifty one for a bomber. Decrease in the speed of the present Ju-88 may be accounted for by the fitting of armor and additional guns.

The Ju-88 has been in service on all fronts. It launched the first aerial offensive against the Russians and appeared in large numbers in North Africa. Its companion in misfortune in 1940 was the Heinkel 111, a low-winged all-metal cantilever monoplane powered by two 1200-hp. Jumo engines. This was a development of the Heinkel transport plane, on which the Luftwaffe was conveniently training pilots on the night mail run from Berlin to London and back, before the war. It made its appearance in the rebel ranks during the Spanish calamity, and met the same fate as the Ju-88 in the Battle of Britain, for the same reasons.

The latest model Ju-88 which the Germans use for high-altitude reconnaissance is a considerable improvement on the early type. In

September, 1943, a young Nazi pilot fed up with the war made the Allies a present of one of these machines which had only come from the Junkers factory the previous June. Attached to the control wheel was a card stating it had flown less than fifty hours and installed was a camera designed to take photos five miles above the earth. The young pilot landed it on an Allied airfield, saluted the guards who came to meet him, and gracefully handed over the machine. An American pilot later flew it across the Atlantic for inspection by the United States Matérial Command. Inspection revealed several interesting details. One was that both three-bladed propellers revolved in the same direction, thus giving the machine considerable torque effect. Another was a unique gun rack which could be fitted in the bomb bay. This held six rifle-caliber machine guns firing downward for troop strafing. Another fitment enabled two 1000-pound bombs to be carried under the wings, the increase of weight being compensated by reduced fuel capacity. The use of the gun rack for downward firing is interesting, when we remember that in 1918 a Junkers troop-strafing machine made its appearance over Allied lines with exactly the same fitment.

The captured ship was light on armament, everything possible being sacrificed in the interests of speed and altitude. Only four guns were fitted, the forward-firing gun being eliminated, the pilot probably counting on his speed and maneuverability to take evasive action if attacked. For the Atlantic flight the U.S.A.A.F. removed all available equipment and installed fifteen auxiliary tanks from a P-38. The Air Force's verdict on the ship after examination was that manufacture and materials were excellent.

During 1943 the Germans used a new Junkers type for daylight raids against England. This is the Ju-288, a fighter-bomber somewhat resembling the British Hampden and about the same size as the Me-210. These machines, one of which was shot down, are fast, heavily armed fighter-bombers, fitted with wing brakes for dive bombing and capable of being used as torpedo planes.

The Dornier 215 is another all-round performer that has been considerably improved since its first appearance in the war skies. A high-winged cantilever monoplane with a maximum speed of 312 miles per hour, it was probably the most successful machine of all the German bombers in taking evasive action and displayed qualities which were later embodied in the Do-217, descendant of the Do-17, which was used mainly as a reconnaissance bomber in the early days.

The Dornier 215 had four machine guns for protection and

showed itself to be more maneuverable than the other bombers. According to reports current at the time, the Germans actually began fitting additional armor to the Do-215's during the progress of the Battle for Britain, and several were shot down to reveal improvised protection for the pilots and crew, the added weight of which reduced the bomb load.

From their losses in the Battle of Britain, which will probably rate as the most outstanding aerial engagement in our lifetime, the Germans learned a great deal. They immediately went to work to modify their existing models, rather than to produce new ones which would entail retooling of factories, and costly loss of production hours.

The present Luftwaffe has a number of tough all-rounders, the most outstanding of which are the Do-217E2 and the current Ju-88. The Ju-88 has never been out of action since the war began. The Russians have hammered them out of the skies on all fronts, and they have been operating in North Africa and Italy. Its design has changed little. Some types are equipped for rocket-assisted take-offs, and some have jettisonable gas tanks for long-range reconnaissance.

The Do-217E2 is a high-altitude bomber, a dive bomber, a night bomber, and like other German bombers can be used as a torpedo plane. The British hailed it as the best all-round German airplane, but the nonappearance of these machines in any quantity on any front contributes to the outstanding mystery of the state of the Luftwaffe. One thing that can be said about the Do-217 is that it has been good at all the jobs for which it was intended. It has a high wing loading and although it has a span of only 62 feet, it carries over 6000 pounds of bombs. Perhaps the most interesting feature is a dive brake which opens rather like an umbrella below the tail, a novel fitment in addition to the usual wing brakes. British reports on a captured machine which came down intact during a high-altitude reconnaissance flight over England revealed that Dr. Dornier, the designer, seems to have put everything except a tile bathroom in this remarkable machine. Such items as a collapsible dinghy in an armored compartment, a device for pulling the machine out of its dive, a cunningly contrived armor plating, to deflect rather than absorb bullets, leakproof armored tanks in the wings, and at least six guns and one or more cannon are included in this aircraft. The entire job is well streamlined and has a speed of over 300 miles an hour.

In the Heinkel family, we find the latest version of the He-111 still with its glass nose, but with additional armor and such devices as apparatus for cutting the cables of barrage balloons, and a 20-mm. firing forward underneath the fuselage.

The Heinkel can be used as a torpedo plane, and reports from the convoy route to Russia occasionally mention the attacks by these machines, fitted with two torpedoes. The range of this plane is over 2000 miles, making it ideal for convoy raiding. Its bomb load is in the neighborhood of 4000 pounds.

Two other Heinkels are of interest. They were reported to be in production in large numbers before the tide of war turned against the Axis. Both these bombers were in line with the German effort to overcome the defenses of Britain and perhaps carry the war to the United States. They are the 116, a high-altitude bomber with pressurized cabin and four turbosupercharged motors, and the 177, a heavy bomber which has been used in small quantities on the Russian front and over Great Britain.

The He-177 is a big fellow, bigger than any other German machine, with the exception of the Blohm and Voss flying boat and the Ju-290 transport plane. In it may lie Hitler's dream of air conquest of Britain, by carrying huge bomb loads over existing aerial defenses. Credited with a range of 7000 miles with some eight tons of bombs, the He-177 appears to have all the makings of a terror of the skies. It is powered by four 2300-hp. liquid-cooled engines, set in tandem in two nacelles driving two propellers. Using turbosuperchargers, it is reported to be able to fly at 45,000 feet. This, of course, may be a rumor emanating from the Axis fear-provoking factory, but this statement is in line with the general development of German types into high-altitude fliers.

When one of the new bombers made a reconnaissance flight over England at 30,000 feet, it was promptly shot down by British fighters, possibly Typhoons. The R.A.F. report at the time said that the He-177 carried the heaviest bomb load of any German plane, which indicated the Nazi determination to return the compliment in the matter of delivering block busters. The R.A.F. was naturally eager to get another look at the plane and awaited the arrival of more. The second He-177 came over traveling light, however, probably on a photographic mission, and when attacked made its escape. It was flying at 20,000 feet, the favorite operational height of our own Fortresses.

The expected attack on Britain by mass formations of these heavy

bombers did not come. The possibility is that Allied raids have put an end to its construction, which would in any case have been curtailed by the Reich's urgent need for fighter planes. The 177 follows the line of all German bombers in being fitted with dive brakes, which makes it the biggest dive bomber in the world.

Another high-altitude bomber is the Ju-86P, which made its debut over North Africa at an altitude stated to exceed 45,000 feet. This machine, powered by two turbosupercharged 1000-hp. crude oil engines, was fitted with a pressurized cabin, but apparently it lacked armor plating. Two British Spitfire pilots, one over forty years of age, chased the two machines that dared a reconnaissance at this astonishing altitude. Although enduring indescribable agonies because of the altitude, and wresting with frozen controls, both of the Spitfire pilots managed to get within range and shoot them down with their first burst of fire. The Spitfire bullets must have pierced the pressurized cabins of the German machines, because each pilot reported that his victim had gone out of control immediately after being hit, indicating that the crews were unable to withstand the sudden change of atmosphere.

The feat of the two British pilots, who were actually instructors over normal flying age, is one of the epics of the air. They went through terrible attacks of the "bends" and frost-bite. One pilot was almost unconscious when he threw his whole weight against the controls to make his dive on the enemy. After scoring his victory, his engine gave out, and he glided thirty-five miles to land in the sea.

One of the nimblest plug-uglies used by the Luftwaffe in the Battle of Britain was the fighter-bomber version of the Me-110 fighter. The first Me-110's were obviously intended as convoy fighters. Powered by two 1150-hp. engines, and capable of a speed approaching 400 miles an hour, these deadly, heavily armed machines quickly revealed their major fault when put in action against R.A.F. Hurricanes and Spitfires. They were too fast to be maneuverable and were an easy target for the twelve gun machines as they skidded across the skies in their attempts to turn to bring their nose guns on their enemies. Goering himself must have thought the Me-110 the best fighter in the air, because he created his own pet squadron of these machines, painted their noses yellow and sent them up to annihilate the R.A.F. Air Marshal Dowding's pilots shot them down with less difficulty than the Me-109's. I watched a Spitfire squadron slaughter six Me-110's approaching the coast of Britain

in what looked like formidable formation. The Spits sailed in, separated the German planes and polished off three of them. The remaining Messerschmitt pilots began to turn in wide circles, firing their cannon at 1000 yards. The Spitfires went after them in a rat-race, which vanished out of sight.

The failure of the Me-110 as a fighter, and the failure of the Luftwaffe's medium bombers to penetrate the British defenses gave Goering the idea of using the Me-110's as low-flying raiders. At this, with a bomb load of one and sometimes two thousand pounds, the machines were more successful. They swooped in quite low over the coast, and headed for inland targets. But the Germans could never use them in large enough numbers to make the weight of their bombs felt and the R.A.F. soon got their measure. On one of the last raids of the Battle for Britain, six Me-110's raided an English airport. All six were shot down before they reached the English Channel sixty miles away.

Latest version of the Me-110 is the 210 which has a single fin in place of the twin tail assembly of the older version. It is heavily armored, considerably faster than the original, and has the novel feature of remote-controlled guns firing to the rear, the German's answer to the conventional tail turret.

Companion to the Me-210, and perhaps the German's answer to the Mosquito although it is primarily a ground-attack plane, is the Henschel 129. This plane made its appearance in the Tunisian campaign as a bomber, powered by two French Gnome-Rhône engines of 650 horsepower, an improvement over its original 450-hp. Argus liquid-cooled power plants. The Henschel is a neat-looking machine. The nacelle looks rather like the nose of Walt Disney's Mickey Mouse. It is armed with two small caliber machine guns, two 15-mm. cannon, firing forward, and a 30-mm. cannon underneath the fuselage. This last is not used if the machine is carrying bombs. The appearance of the Henschel, however, is taken by some authorities as a clue to the fact that the Luftwaffe is running short of first-line aircraft.

Germany has two types of four-engined bombers which, although capable of considerable bomb loads, are hopelessly inferior to the equivalent Allied products. If Hitler decided to bomb America, he might dispatch a token force of Heinkel 177's in company with his six-engined Blohm and Voss patrol bombers, and perhaps a few Focke-Wulf Kuriers, which were used on Atlantic patrol before the British "Catafighters" put an end to their career.

The BV-222, designed before the war for trans-Atlantic mails, is a ponderous boat on the style of our own Boeing Clipper. It has six 1000-hp. engines and numerous gun turrets. Its top speed is in the neighborhood of 200 miles per hour. When these boats were used to run troops and supplies to Rommel's forces in Tunisia, they were ruthlessly slaughtered by U.S.A.A.F. Warhawks and R.A.F. Blenheims, Beaufighters, and Spitfires, proving their inferiority to the British Sunderlands.

The Focke-Wulf Kurier is a descendant of the German airliner Condor II which flew nonstop from Berlin to New York and back. Elder brother of the Kurier is the Condor I which previously operated on German airlines. It is the big-bully type of bomber, excellent for preying on shipping, but hopeless when attacked by any kind of fighter or well-armed patrol bomber. It is capable of carrying 6000 pounds of bombs, and is equipped with a large number of machine guns and cannon for strafing purposes.

Its extreme vulnerability would seem to indicate lack of armor. There is a legend in the R.A.F. that in every single instance in which a Hurricane or Spitfire has been launched in mid-Atlantic to attack a Kurier, the German plane was either shot down or forced to abandon its project. Several were victims of antiaircraft fire from the decks of Allied freighters. Altogether, this converted airliner has not been a success as a warplane. In comparison with the United States Fortress or Liberator, it is very much a civilian playing soldier.

Although Italy surrendered to the Allies, it is probable that a large number of her aircraft remained in Axis hands, and certain that the aircraft factories in northern Italy that survived Allied bombings are continuing to turn out aircraft.

The Italian air force never asserted itself with any outstanding vigor during the present war. The performance of Italian bombers must have been a source of great disappointment to Mussolini's Nazi overlords. The Italians have always been good airplane designers. The principle behind the general design of Italy's medium bombers was to build them fast enough to outstrip enemy fighters, and before the war much was heard of the Breda 88, which averaged 321 miles per hour with a load of 2000 pounds. The Breda was a heavily armed ship and seemed a formidable proposition, but few of them ever appeared in action.

When Italy declared war on France and Great Britain, she was known to have several excellent types of bombers, in addition to

the Breda 88, which was designed for ground attack and light bombing raids. The Breda had many good features. Constructed partly of wood and partly of metal, it was armed with three 12-mm. guns and one free gun firing to the rear. The pilot sat forward of the wing and the gunner above it, both having an excellent view of the ground. With its compact fuselage, and twin tails, the machine had an exceptionally good appearance. How many were manufactured is not known. Companion of the Breda was the Savoia-Marchetti 85, a twin-engined dive bomber with first-rate performance.

The Italians seemed to share the German idea that if you could build a bomber fast enough to outrun enemy fighters, it need not be armored. They differed from the German theory in one respect. They believed in armament. Since the close of hostilities in World War I, the Italians had been experimenting with cannon and heavy caliber machine guns on their fast light bombers. In the 1920's, we heard of the 37-mm. cannon on a flexible mounting being fitted to the Italian Caproni bombers in such a way that the pilot could shoot broadside to his line of flight. Another experiment was the fitting of a cannon firing along the tail of the bomber, operated and sighted by remote control.

An outstanding feature of Italian design has been the use of three engines in medium bombers. The Caproni, CANT, and Savoia-Marchetti concerns all produced three-engined planes, many of which were exceedingly fast. Typical of these is the all-wood CANT Z-1007, which has a speed of 300 miles per hour, with a multiple crew, and can be used as a torpedo bomber, night bomber, and day bomber. Some of these machines were used in the Italians' attempt to bring the wrath of Italy to London. Most of them were shot down by the R.A.F. Incidentally, the Italian contribution to the Luftwaffe's assault on England revealed that Mussolini's airmen lacked a regular supply of bombers. The machines sent on the two daylight raids on England were an odd assortment, including the heavy Caproni Reggiane bombers, some smaller Caproni CA-135's, and the CANTs.

The Italians did not distinguish themselves. One morning when the Battle of Britain was at its height, a squadron of Hurricanes which had been forced to land through exhaustion of ammunition was informed that a flight of enemy bombers was proceeding up the Thames Estuary. All available fighters were busy, and the situation looked grave. The Hurricane squadron and a reserve squadron took the air, however, and found the "Eyties" wandering leisurely up the

Thames. The British fighters attacked, and the Italians spewed out their bombs and fled. Few of them returned home. An R.A.F. pilot related that he had chased one Caproni out to sea. It was burning fiercely. The Italian pilot waved his handkerchief as a sign of surrender, and then dived into the water with a terrific crash, scattering wooden wreckage all over the surface.

Italian bombers attacking Malta came off little better, and were soon replaced by German bombers.

In the heavy class, Italy has the Fiat BR-20, powered by two 1000-hp. Fiats, and the Piaggio P-108, a low-winged four-engined monoplane, with 1000-hp. radials. Little has been heard of this plane, but it is credited with having an exceedingly long range. If Mussolini had been able to fulfill his boast of bringing bombs to America, the P-108 might have been the Italian bomber to accompany Hitler's He-177's.

Another big fellow is the Savoia-Marchetti SM-82 Canguru, a thick-bellied trimotor aircraft which made the good-will flight from Rome to Tokyo and captured the world's distance record by flying 8038 miles in fifty-six and a half hours. Little has been heard of this bomber during the war, but it was used possibly as a supply ship to the Germans and Italians in North Africa.

With its extensive coastlines, it was to be expected that Italy would develop a torpedo bomber. When Mussolini decided to bolster Franco's rebellion against the Spanish government, the Italian Regia Aeronautica, pilots of which had an exceedingly attractive uniform not unlike the R.A.F.'s except for being liberally decorated with gold braid and including a tiny gold dagger, sent a number of Savoia-Marchetti trimotor bombers direct from their triumphs against the unarmed Abyssinians. These machines later appeared in the Mediterranean as torpedo bombers, and earned the respect of the British to such an extent that one writer picked them as the best torpedo bombers in service.

Altogether, the performance of the Italian bombers has been under expectations, perhaps because their easy victory over the Ethiopians created false confidence.

Except to a few military experts and pilots who have come to grips with them, the Japanese planes are very much of an unknown quantity. Their bombers, however, seem to respond to the treatment of our .50-caliber guns as readily as did the Germans to the onslaught of the eight .30-calibers carried by R.A.F. fighters.

The idea that the Japanese air force is a push-over still remains in many minds. Another widely held belief is that all Jap machines are scrupulous copies of American and British aircraft. Both are untrue. In some cases, however, the Japanese have taken our machines and modified them to their own use, or built their own machines on the same lines.

To the British goes the dubious honor of teaching the Japs to fly and providing them with the nucleus of the air force that struck at Pearl Harbor. The attack at Pearl Harbor proved, however, that the Japanese belief in their own air power was only half-hearted. Had they backed up their sneak air assault by an invasion fleet, or raided the area seven days and nights in succession, we might not be in such an optimistic situation in the Pacific. I think the Pearl Harbor attack proved above everything else that the Nipponese held the same view on aerial bombardment as the Germans, and perhaps they were even a little more conservative.

Fortunately for us, the Americans and the British are the only two powers with an intelligent grasp of the use of air power. The Germans failed to follow up the Coventry raid, which in itself showed the British how devastating a saturation raid could be, and the Japs did not return to finish the job at Pearl Harbor.

The story of Japanese air power goes back to the early twenties, when the Master of Sempill, now Lord Sempill, an exceedingly air-minded son of a Scottish peer, led an air mission to the Japanese. As a reward for her services in World War I, the British Navy was obligingly training Japan to fight her battleships along modern lines, and the Japanese Naval Attaché in London asked for a Naval Aviation mission to be sent to Tokyo. The Japanese government was prepared to pay handsomely for the privilege of learning at the feet of the white officers, and so the matter was arranged.

To Tokyo went twenty-eight specialists, all of whom were given honorary ranks in what the Japanese obligingly translated into English as The Imperial Japanese Naval Air Service. The Master of Sempill was made a captain, and others were awarded the rank of warrant officer. The Japanese expedition took along fifteen of the best British machines. These included the latest flying boats and amphibians, the SE-5a, and the Gloster Sparrowhawk. The latest equipment was included, Hucks starters, bombsights, torpedoes, and parachutes, everything necessary to start a naval air service.

When the mission arrived, they found Japanese land fliers being trained by the French who were also grateful for the aid given

against Germany in the war. Lord Sempill told me on his return that the Japs were still in the 1914 stage of aviation, but they were quick to learn and determined to have a naval air service at all costs.

In the short period of eighteen months, they built a most efficient training station supplied with qualified instructors. From 1923 onwards, Japanese naval flying made steady progress. Japanese Air Attachés to the democratic countries negotiated contracts to purchase suitable machines, and everything possible was done to insure an air service adequate in number and performance for its task of "defending the Imperial shores," as a Japanese writer put it in a British aviation magazine.

The Japs were exceedingly proud of their new air arm. The best pilot material went to the Navy, which set the pace over the Army in airplane development.

In 1938, a Japanese air correspondent offered me, for publication in the magazine I was editing, a well-written piece concerning Japanese aviation. It began modestly by stating that although the Japanese planes were not much better than the Chinese, which I observed were almost nil, the Japanese air force was the best in the world, because of its superiority in aerial bombing. He went on to state that in the bombing of Hankow all the bombs hit the military targets from a height of 12,000 feet, with the result that no Chinese civilians were killed. There was then a considerable amount of Fascist propaganda, particularly against the Spanish government, and a statement that twenty Japanese bombers had met twenty Chinese pilots flying Gladiators (British planes) and shot them all down. The writer also naïvely stated that every Japanese pilot has to accomplish his mission despite weather conditions, and that he will if necessary dive his bomber into the target to insure destruction.

He went on to say that the crew of each Japanese bomber sent against the Chinese, who were flying "deadly pursuit ships," carried small Rising Sun flags with them which they waved valiantly as they plunged to their death, if shot down.

There was also a story of a Japanese naval pilot shot down over Nanking. He had dived "in the middle of the enemy so that his bombs would destroy them." He had written to his parents: "To die for the Emperor is the duty of every man. In the period of national crisis I became an officer in the Imperial Navy, and thanks to the guidance and training of my superiors, I was able to attain the position I am now in . . . soon we shall be fighting the world, and our noble fliers will shatter all our enemies." The piece, which eventually

appeared in another magazine, ended with the statement that the country was proud of its heroes, who not many years before had never seen an airplane.

Remembering this glowing report of Japanese exploits against China, who seldom had more than two fighter planes in running condition at one time, prompts me to wonder what terrific build-ups the Japanese pilots must get today when they are being so thoroughly trounced by the American pilots flying Wildcats, P-40's, Corsairs, Catalinas, and any kind of plane now in action in the Pacific and over Burma. It shows, however, that these little men tend to make up in fanaticism what they lack in plane performance.

Just as the Germans tried out their bombers in Franco's inglorious Spanish "rebellion," so the Japanese gave their warbirds a preliminary try-out in their so-called China incident. In adapting their civilian types to military use, they likewise followed the German example.

Many of their machines are development of German, British, and American types. The Navy's Mitsubishi OB-96, which was used extensively in China, is a development of the civilian Junkers type sold to the Japs by Germany. This machine, powered by two 1000-hp. engines, could carry a ton of bombs over a range of 1000 miles and was liberally armed.

The Japanese Army's equivalent of this bomber is the Mitsubishi OB-97, distinguished by its tapering wing tips and exceedingly small aspect ratio. It has an exceptionally long second cockpit amidships of the fuselage and is credited by the United States Navy with a speed of 191 miles an hour and a service ceiling of 23,000 feet. These bombers have a much greater load capacity than the OB-96, but would seem to be extremely vulnerable, having been slaughtered unmercifully by the United States Navy and Marine pilots in the Pacific.

During a raid on Milne Bay on the southwest coast of New Guinea, more than thirty Japanese bombers out of fifty, protected by fifty fighters, were shot down; while Japanese bombers operating out of Burma against India suffered such heavy losses that their operations ceased entirely. A British Blenheim on reconnaissance encountered two of these aircraft and disposed of them. Compared with United States Mitchells and Marauders, these bombers are well out of date.

One of the most successful Japanese planes is the Mitsubishi OB-01, an all-Japanese product, the plane probably used against

the *Repulse* and the *Prince of Wales*. The OB-01 is a carrier or land-based bomber, and has a gun position in the tail. It is powered by two radial engines probably of 1000 hp. each, and it carries two torpedoes or their equivalent weight in bombs. An R.A.F. report on this ship describes it as equal to our best medium bombers, but no details are available as to its performance.

Another Japanese dive bomber, the Aichi K-99, is a comparatively outmoded plane powered by a 900-hp. radial. It has a crew of two and a maximum speed of 200 miles per hour. It might be considered the counterpart of our Douglas Dauntless, but would be inferior in all-round performance.

The Japanese Army's Showa SB-99 is a replica of our own Vultee attack bombers, which were widely sold to foreign nations.

Seaplanes figure largely in the Japanese Naval Air Service. Many of them reveal their inheritance of design features from the British Short seaplanes sold to the Nipponese many years ago. British influence similarly shows in their flying boats. One of these, the Mitsubishi H-96, closely resembles the Short Calcutta, from which it was built under license. The H-96 is a biplane with three radial engines in line between the wings and is probably used for antisubmarine patrol.

The Japs are also known to have one or two types of four-engined flying boats.

The largest of these is the Kawanishi T-97 which is a development of the Kawasaki flying boat that operated on the prewar Yokohama–Saipan service. This aircraft is a development of the Sikorsky S-42B. The T-97 has made frequent appearances in the Pacific as a bomber and as a torpedo plane, and one of them featured in an epic encounter with a United States Navy Catalina which ended in defeat for the Jap plane, but only after severe damage had been caused to the Cat. It is powered by four 900-hp. double-row Kinsie radial engines which give it a cruising speed of 215 miles per hour at 13,000 feet. Its maximum range is about 1500 miles. Weighing 45,000 pounds, it carries a crew of ten men and 3500 pounds of bombs. The T-97 is probably one of the best armed of the Japanese bombers, being equipped with 20-mm. cannon in the nose and dorsal, or tail turrets according to the type. It has a span of 131 feet and is distinguished by its wide thin wing, with a deep rectangular center section extending to the outboard engines. Outboard from the center section the wings taper to rounded tips.

Another four-engined design is the Hiro H-97, a big fellow pow-

ered by four liquid-cooled engines and capable of a maximum speed of some 200 miles per hour. The Hiro has made its appearance in the South Pacific, but no definite news seems to be available as to its reaction when attacked by United States fighters.

In considering the Japanese air force, it is well to remember that while many of the types now in use are out of date, there is no reason to suppose that Japan, with German help, is not producing better airplanes for her defensive war in the Pacific. Reports have been received to the effect that the Japs have been throwing ten-year-old types into the air battles in the Munda area. This does not mean that Japanese air power is cracking. It may be staggering under the blows dealt it by American and British air forces, which have been most persistent, and the enemy may consider that replacement of the old types would be a waste of production.

Typical of Allied blows were three engagements during April, 1943. Off Tulagi, American fighter pilots destroyed thirty-nine Japanese planes out of ninety-eight attacking. At Oro Bay, twenty-three out of forty-five; at Port Moresby, fifty-two out of one hundred. These losses are heavy and would make replacements difficult. While retooling their factories to produce better machines, the Japs may have thrown in their reserves of old planes. Up to the time of writing, Japan, like the United States, is one of the two nations in the world able to retool and produce airplanes out of range of enemy bombs. Japanese aircraft production is known to be increasing, and Tojo has called for "far better achievement" in the future. Using German mass production methods and German designs, the Japs might spring a series of surprises on us.

Japan's air development has probably suffered a serious blow in the death of Commander Suteji Muroi, who was credited with the planning and development of the Imperial air arm. Muroi went to Germany in 1939 to study aerial war at the Luftkrieg Academy in Berlin and returned to Japan after visiting the Western and Eastern fronts. Another arrival in Japan at the time was the notorious Fritz Weidemann, former German consul in San Francisco and personal friend of Hitler. Weidemann was supposed to have brought the Japanese a scheme for mass production of one fighter and one bomber type of aircraft.

Raids on the American mainland are constantly being threatened by Japan's warlords. Major General Kenryo Sato has stated over the radio that such preparations are already at hand. Probably they are, perhaps with Jap-built He-177's, or a specially designed long-range

plane to operate from carriers. Anything is possible when you are opposing a fanatical enemy.

Let us hope that before these planes can be put into action, our own bombers will have blasted every Japanese aircraft factory of importance. If you look at the map of the Aleutians and consider the range of our new bombers, you will see that our chances of bombing Japan are better than her chances of bombing the United States.

Chapter Sixteen

THE FUTURE

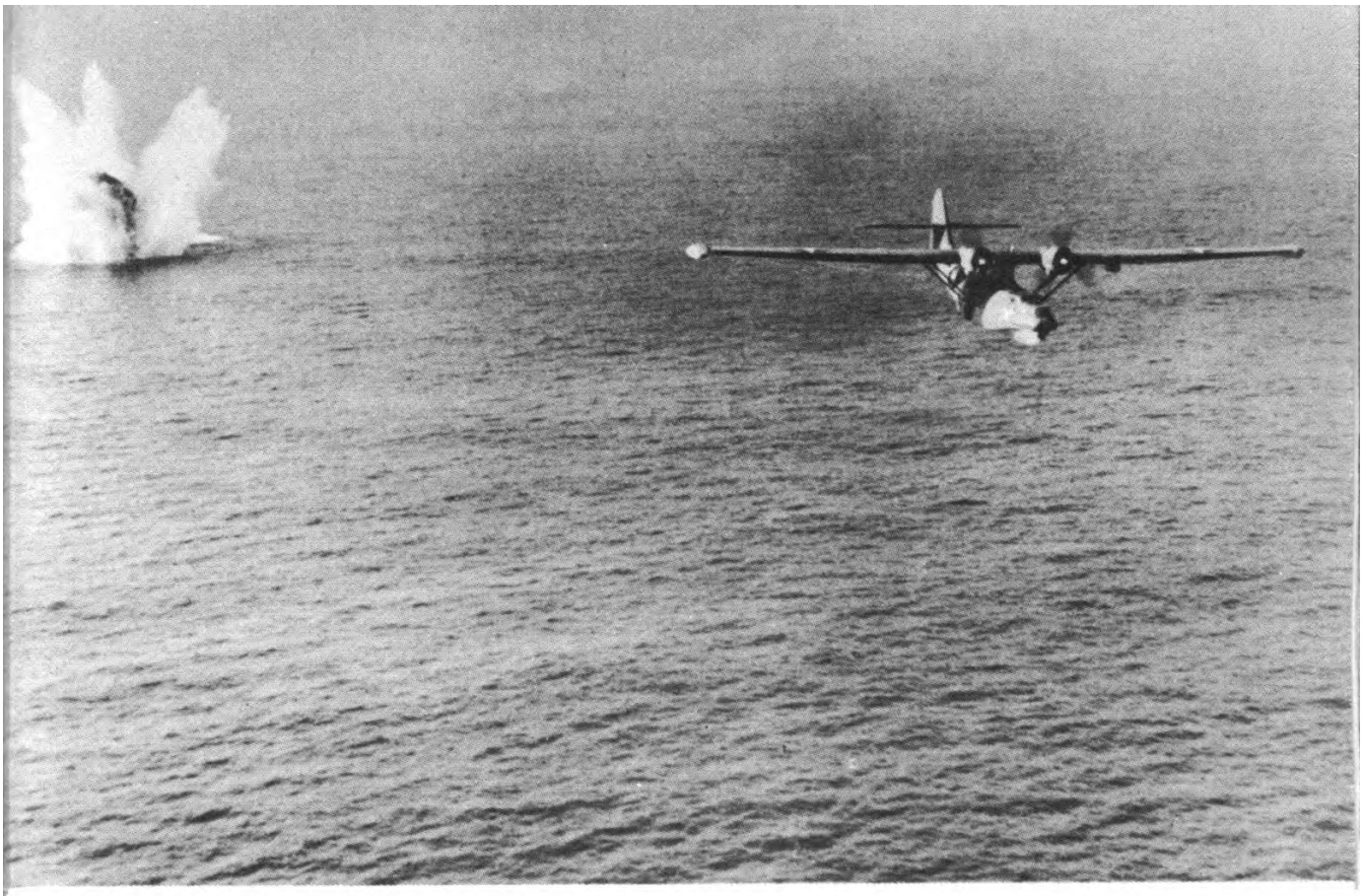
PRODUCTION of all weapons of war is governed by necessity. The airplane, because it can be produced with comparative speed as compared with the battleship and other heavy weapons, is a typical example of a weapon custom-made to meet circumstances, adverse or otherwise.

Of all American airplane types the heavy bomber and its cousin, the transport plane, have made the swiftest progress of design and performance. Britain has had to carry on with modifications of her 1936 bombers, Germany has had to switch her production to fighter planes to ward off the attacks of Allied bombers. The United States has developed her Fortress and Liberator to the limit of their capacity, and at the same time has developed the super-bomber which would seem to fulfill the dream of those who have supported the theory that the bomber should be an aerial battleship. The idea is not new, of course, when you remember that it prompted the original design of the Fortress in 1935.

General Arnold, the Commanding General of the Army Air Forces, who has been a consistent advocate of bombardment aviation, has on several occasions prognosticated the future of American bombardment with the promise of super-bombers that will make the Liberator and the Fortress seem comparatively small. The Gen-

eral, to whom must go a great part of the credit for building the world's largest air force and stimulating the production of material to equip it, reported as far back as the summer of 1942 that the U.S.A.A.F. were steadily improving the standard models of fighters and bombers, and that new fighters and bombers were on the way with tremendously increased speed, fire power, bomb loads, range and maneuverability, indicating that the latest American aero engines, both air and liquid cooled, had been vastly stepped up in horsepower. General Arnold, who as many know was one of the first three army officers to learn to fly, has never been given to boasting; neither can it be said that his Army Air Forces have ever been guilty of the misuse of air power. The sole mistake that can be laid at the door of the United States was a lack of numbers of fighters in the early stages of the Pacific combat, a fault to which democratic nations who think in terms of peace rather than war are always prone.

In his report to the Secretary of State for War, the General wrote that the No. 1 job of an air force is bombardment, and that the United States must have long-range bombers capable of hitting the enemy before he hit us, that planes had to be built to function under all climatic conditions, from the North Pole to the South Pole, that the United States Army Air Forces believed in daylight operations and the strategic precision bombing of key targets deep in the enemy's territory, adding that from 1935 to 1938, despite limited budgets, the Army Air Forces developed detailed plans for a fighting air arm. General Arnold's report is one of the most important documentations on air power made public during this war, and deserves far more attention than was given to it in the daily press. It is of particular interest because the General not only takes the public into his confidence in revealing how the United States has used its air power, but gives a large share of the credit for the building of the world's largest air force to Americans. This is how he puts it: "In the most direct and personal sense, the building of what is now the world's largest air force involved 130,000,000 people. Our enterprise reached the lives of every American. Industries were mobilized, plants were constructed or converted with dazzling speed, millions of our citizens pulled up stakes and pitched into work at hand with the spirit, resourcefulness, and enthusiasm of our country's pioneers. The high school graduate put his diploma in a bureau drawer, and enlisted as an aviation cadet. The housewife became a welder, three thousand miles from home. The farmer and his family



(Above) A Catalina drops a depth charge, sending up a triple-pronged jet of spray. (Below) Two Catalinas return to their Aleutians base from long-range patrol over the North Pacific. The seaplane tender that is hauling the first Cat alongside stocks fuel, ammunition, and supplies for the flying boats; feeds and provides sleeping quarters for their crews. *U. S. Navy.*

This Catalina hit a hidden reef in the Aleutians and is beached for repairs. Water is now being pumped from her bilge. *U. S. Navy.*

walked to church on Sunday to save half a gallon of gas for use over embattled Henderson Field. The skill, devotion, and hope of our people were focused on Army Air Forces."

In those few words the General gives a picture of the work behind the scenes in building bombers, of men and women learning new crafts, of piano factories making bomber parts, of girdle manufacturers making parachutes, of pickle plants turning out airplane skis and floats.

The results of this labor are seen in the American airplanes gaining control of the air on every front on which they appear, in well-trained air crews, in constantly populated supply lines, in the mass of spares and the tons of gasoline brought across land or ocean to the fighting front.

The U.S. super-bomber, the B-29, is a result of the Army Air Forces' policy to keep ahead of the enemy by building weapons to match its policy of aggressiveness. The B-29, which is a super-Fortress, is the United States aircraft industry's super achievement in bomber design and production. This massive giant, heavily armored and armed, has a span of 141 feet, a length of 99 feet and a wing area of 1739 square feet. It is powered by four specially modified Wright Cyclone Duplex engines of 2000 hp. each driving a three-bladed air screw, has a cruising speed of 250 miles per hour at 25,000 feet, and can carry a bomb load of 17,500 pounds on a 1000-mile trip, or 6000 pounds on a 3000-mile sortie. Details of its armament are secret. Into it will have been built the experience gained from combats on all fronts. Certainly it will have chin turrets, or forward-firing guns, increased dorsal and ventral fire power, and some models will possibly carry heavy cannon similar to that installed on the B-25. The weight of the new monster, said to be between 100,000 and 120,000 pounds (twice that of the British Lancaster), is carried on the ground on a tricycle undercarriage each unit of which has twin-tired wheels.

Built for high-altitude flying, the operation of the new bomber requires special crew training, put into operation as the result of tests made on the experimental B-19. The opening of bomb bays at extreme altitude involves abrupt changes of pressure and temperature in the fuselage of the bomber, which must be compensated for to prevent discomfort to the crew and reduction of efficiency.

Whether the B-29 will be the last of the big bombers to appear in this war is a matter on which no one would dare to hazard a guess. The chances are that it will be, basing one's assumption on the life

of the Fortress which will be ten years old in 1945, and which has undergone numerous type modifications. The life of an airplane type is short in war, but just as the Fort was several years ahead of its time, so the B-29 can be expected to head the opposition by several years.

1943 saw the introduction into aviation of several new devices which may be featured as regular fitments on the bomber of the immediate future, and may even be included in the modifications made to existing types. One of the most important of these is the perfection of dual-rotating propellers by the Curtiss-Wright Corporation of America and the De Havilland Aircraft Company of England.

The dual-rotating propeller is the answer to many of the airplane designers' most harassing problems, particularly that of obtaining thrust efficiency at extreme altitude. Previously one of the great bugbears to altitude flight was persuading the engine to give full revolutions in the rarefied air which reduced the pressure on the induction pipe, and caused the engine to splutter and cough with a woeful loss of horsepower. This has been overcome by the fitting of the turbosupercharger perfected by the General Electric Company. The turbosupercharger is a device worked by the exhaust gases of an aircraft engine, acting on an impeller which compresses the air to give it sea-level pressure, thus insuring the same combustion performance as at sea level. The turbosupercharger is the most economical way of getting results, being far lighter than the mechanical supercharger operated by gears on the engine crankshaft. It is the nearest thing to perpetual motion imaginable and actually derives its power from the exhaust gases which are the waste product of the engine. It operates automatically and cuts itself out when atmospheric pressure is equivalent to that of sea level. Planes fitted with turbosuperchargers can operate at 30,000 to 35,000 feet, with their engines giving the same power as at sea level. A nonsupercharged engine loses more than 50 per cent of its power at 25,000 feet owing to the reduction of atmospheric pressure.

The high-flying airplane has another problem, however, and that is propeller slip, which is a reduction of thrust caused by rarefied air, eddies and turbulence. The thrust of a propeller is the distance the airplane should travel according to the pitch of the blades, if there were no slip. Pitch is the angle at which the blades are set to the air.

If a propeller were turned in an element having the consistency of butter it would progress forward the exact distance through which

the propeller would advance in one revolution. Slip is always present in atmosphere, and from the beginning of airplane design men have tried to overcome slip.

The Propeller Division of the Curtiss-Wright Corporation kindly provided me with their latest data on propeller performance to assist in my explanation of the dual-rotating propeller which may soon be giving American bombers that little extra plus in propulsion efficiency.

An airplane's propeller corresponds to the wheels and transmission system of your automobile. It absorbs engine power and converts it into motion. The angles (pitch) of the propeller blades are equivalent to the gears of the car. Low gear starts an automobile, low blade angle is used for airplane take-off. Medium pitch is second gear, greatest angle, high gear. The pilot, however, need not worry about changing his gear. His automatic pitch control does that for him. On a single-engined plane he has a transmission worry though—*torque*. The rotation of the propeller tends to make the machine turn over laterally. The pilot corrects this with his rudder or fin tabs.

The twin-engined bomber torque is counteracted by the propellers on each engine turning in opposite directions.

Early airplane propellers had two blades, because people thought any additional blades turning in the same air path were wasted weight. Later it was proved that a three-bladed propeller is nearly one and a half times as efficient as a two-bladed one, and a four-bladed a little less than one and a third times as efficient as the three. The *little less* efficiency is accounted for because one blade passes through air distributed by the blade in front of it. To fit more blades was not practical; neither could the length of the propeller blades be increased, because the diameter of the propeller is limited by the height of an airplane's landing gear and its ground clearance.

The 2000-hp. engine fitted to modern bombers and fighters demands the highest possible efficiency in propellers. To make the greatest use of this colossal power, 2000-hp. planes are fitted with three- or four-bladed propellers, but there is still slip and a marked loss of thrust at high speed.

In their quest for more thrust, efficiency, and greater speed, engineers thought of utilizing the air in front of the circle of rotation of the four blades. The principle was first demonstrated in the Italian Fiat-Macchi seaplane which topped 400 miles per hour in 1930. This tiny monoplane had two engines each driving a two-bladed fixed-pitch propeller in opposite directions. The handicap

of fixed pitch, however, outweighed the advantages provided by the variable-pitch three-bladed propeller assemblies then developed.

When the variable-pitch blade system had been perfected, the designers again turned their attention to dual-rotating propellers, and today on both sides of the Atlantic these propellers are ready for action.

United States planes have already been fitted with the Curtiss-Wright six-bladed unit, which actually consists of two hollow three-bladed variable-pitch propellers driven in opposite directions by one engine.

The perfection of the new propeller is a saga of American engineering endeavor and persistence. Experiments were wearisome, often heartbreaking. But from each failure much was learned. Most gratifying discovery was that the front propeller set sufficiently ahead of the other to allow for blade angle changing, but did not cause the expected excessive turbulence that might adversely affect the thrust of the rear blades.

The explanation is that the front propeller works in undisturbed air, the rear in the compressed slip stream of the other. Laboratory tests showed this slip stream follows the rotation path of the tips of the front blades and also of the angle of the blades, making pressure in two separate directions. The rear blade, however, rotates against the directions of both these pressures and therefore is turning in the compressed flow of solid air forced back by the front blades.

In early flight tests "bugs" began to manifest themselves. It was found that at take-off speed, the slip stream set up by the angle of the front blades resisted the slip stream created by the rotating propeller tips, which meant that the rear propeller blades had to be set at a sharper angle than those in front. Under such conditions the gain in thrust was so little that the weight of the extra blades seemed hardly worthwhile.

Then someone discovered that at high speeds and high altitudes, where the increase of power was most needed, the two opposing slip-stream forces obligingly unite into what amounts to a solid thickly compressed layer of air. This gives the rear propeller such an efficient blade bite that it has to be set at a lesser blade angle than the front.

All the pilot has to do is to climb to the desired altitude. As he opens his throttle the efficiency of his propellers increases with his speed, instead of decreasing as with the normal type of propeller; and at all speeds and altitudes he has no engine torque. That has been

canceled out by the two propellers rotating in opposite directions. He can fly his machine hands and feet off, and throw it about in aerobatics in any direction with equal ease. Ask any of your single-engined pilot friends what this means and watch his eyes glisten. For the trainee dual-rotating propellers mean an end to the dangerous and humiliating ground loop (when the plane tears round in a circle like a bee in a bowl); for the single-engined dive bomber they mean quicker arrival at the target and more deadly accuracy. To the single-engined torpedo plane pilot they bring an even greater advantage of ease in straight shooting and, of course, greater speed in getaway.

These propellers mean a lot to postwar aviation. By increasing engine efficiency their use will produce higher speeds on lower fuel consumption, and consequently lower fares and freight rates, both vital if we are to make the fullest possible use of air transportation. You will hear a great deal about these dual-rotating propellers in the future. They are as revolutionary to the modern airplane as was the three-speed gear to the bicycle, perhaps more so.

A bomber fitted with four 2000-hp. turbosupercharged engines operating dual-rotating propellers would have the most efficient means of propulsion aeronautical science can provide, and be capable of operating at all heights with the greatest economy of fuel and mechanical energy.

There is, however, yet another revolutionary means of propulsion which has been brought to perfection after years of experiment. This is jet propulsion. Jet propulsion is the giving of forward motion to the plane by means of the discharge of gas, on the same principle as the rocket. Jet propulsion is not new. In 1660 Sir Isaac Newton, the English scientist, produced a model of a vehicle using a steam jet to give it forward motion, but long before, in the dark ages, Hero, the Alexandrian philosopher, was working on the same principle, and developed a turbine with jets of steam turning a sphere. In 1910 a French inventor published drawings showing how jet propulsion could be employed on the supercharger principle, but it was many years before aeronautical engineers began to give serious thought to the possibility of using jet propulsion for aircraft. The Caproni Company of Italy was the first to make public news of successful flights, although Germany and England were known to be experimenting with jet propulsion. In 1941 a Caproni jet-propelled airplane made its first flight averaging 130 miles per hour from Milan to Rome, with one stop en route. This machine was fitted with a

normal radial aero engine driving a compressor which sucked air in at the nose of the plane. The compressed air, first heated by the engine, then by mixing with the exhaust gases, is given further expansion by the injection of liquid fuel at the point of discharge in the rear of the plane.

The result of this is to produce the effect of a rocket explosion, and thus provide forward motion. Rockets said to be invented by the Chinese were first used in Europe by Sir Sidney Smith in 1806. He bombarded the French port of Boulogne with rockets, but they seemed to be inaccurate and did little damage. The Germans used rocket force on a boat in 1930, and then began to employ them in rocket planes. The use of rockets in planes led to the employment of liquid fuel, and this encouraged experiments in jet propulsion using mechanical compressors to mix atmosphere and liquid fuel to obtain high explosive force. The National Advisory Committee for Aeronautics held an investigation into jet propulsion and reported that when perfected the system should be 80 per cent more efficient than any other power system in use. A joint announcement by the United States and British air forces, stating that a new type of jet-propelled plane based on designs perfected by Captain Frank Whittle of the R.A.F. was being manufactured by the Bell Aircraft Corporation, centered interest on the new type of propulsion. The new machine flew for the first time in May, 1941, and has since made hundreds of successful flights, many at high altitudes and extreme speeds. But warned a British official spokesman: "Dramatic as the advent of the new weapon may be, its immediate use in operation should not be expected. Plans are being made for the production of training models, but there is bound to be a considerable time lag between going into production with the new plane and getting it into service. Furthermore, the technique of flying a jet-propelled plane is quite different from that of flying a screw-propelled aircraft. Even when training models are delivered more time will be needed to train the pilots."

This writer's hazard is that it will be many years before jet propulsion is featured in bombers. It has certain advantageous features for immediate use in interceptors, namely, weight saving for power ration, and excessive speed and altitude.

Rocket propulsion may be employed to launch heavily loaded bombers at take-off. The Germans already use this principle to get their Do-217 and He-177 off the ground, but the advent of the dual-rotating propeller and the perfection of the 2000-hp. unit would seem sufficient. Even more powerful engines may follow the present

type. The British already have a 2400-hp. liquid-cooled aero engine smaller and slimmer than anything yet produced, which may replace the Merlin for their heavies and point the way to more powerful engines for our own.

One final thought in considering the bomber as an airplane. Every progressive step in its design, every increase in its design, is of immense importance to commercial aviation and a contribution to the postwar world. While the fighter is a freak airplane bred for speed and destruction, the bomber is the unit of weight carrying. Our present bomber types stripped of their armament will surprise the world by their utility and durability. While the fighter planes go on the scrap heaps, the bombers will carry on as work-horses of commerce, and from them will come the super-efficient transport planes of the future, to which we confidently look forward. To the bomber we also look for the preservation of world peace, by keeping the world's potential trouble spots within a matter of hours from corrective armed power, if ever occasion arises for its use.

Here is a salute to the bombers, large and small, to the men who fly them, to the men who fight in them, to the men and women who manufacture them, and keep them flying. Of them it may truthfully be said, they make a major contribution to the future world.

Of them it may well be said in the words of the prophet: "And after these things I saw another angel come down from heaven having great power . . ."

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